PRECISION STRIKE ASSOCIATION

Precision Strike

Annual Programs Review

"Precision Engagement – Adapting Technology to Meet Warfighter Needs"
24 – 25 April 2007

Arlington, VA

Tuesday 24 April 2007

***JOINT CRITICAL INITIATIVES FOR PRECISION ENGAGEMENT*:** *Mr. Douglas Cassidy*, Joint Integrated Fires Deputy Division Chief (J-8), U.S. Joint Forces Command

PRECISION ATTACK TO ENSURE DOMINANT MANEUVERS:

- **Strategic/Operational Perspective:** *Colonel Bob Cunningham*, USA Chief of Precision Strike Division, Army G-8
- **ATACMS and Guided MLRS:** *Lieutenant Colonel Mark Pincoski*, USA, Program Manager
- **Excalibur:** *Mr. Roger Savage*, Cannon Ammunition Synchronization Officer for Army (G-8)
- **NLOS-LS:** *Colonel Chuck Bush*, Chief of Force Development for FCS, Army G-8
- **Course Correcting Fuzes/Precision Guidance Kit:** *Mr. Russell Hill*, PM, Combat Ammunition Systems, US Army ARDEC, Picatinny Arsenal

RELIABILITY & SUSTAINABILITY OF WEAPONS SYSTEMS: *Dr. Ernest Seglie*, Science Advisor to Director, Operational Test & Evaluation, OSD

Wednesday 25 April 2007

KEYNOTE ADDRESS: ***PORTFOLIO SYSTEMS ACQUISITION ROLE IN THE NEW ACQUISTION & TECHNOLOGY STRUCTURE*:** *Mr. Dave Ahern*, Director, Portfolio Systems Acquisition, OUSD (Acquisition, Technology and Logistics)
JOINT DEEP STRIKE SYSTEMS:

- **Long-Range Strike Update:** *Colonel (S) Gary Mausolf*, USAF, Chief, Air Force Weapon Requirements, AF/A5RW
- **Prompt Global Strike:** *Major Greg Jones*, USAF, Chief, Spacelift Requirements Branch, A5RM
- **USSTRATCOM Organization for Global Strike Execution:** *Lieutenant Colonel Ed Donaldson*, USAF, Deputy Champion, Global Strike CONOPS, AF/A5X

A TECHNICAL PERSPECITIVE OF NETCENTRIC C-2: *Dr. Ronald C. Jost*, Deputy Assistant Secretary of Defense for C3, Space and Spectrum, OASD for Networks and Information Integration
SEA AND LAND STRIKE SYSTEMS: "Ship to Objective Maneuver enabling technology"

- **Strategic/Operational Perspective:** *Captain Ed Barfield*, USN, Deputy Director, Expeditionary Warfare Division (N-85)
- **Navy-DDG 1000/ Long Range Land Attack Projectile & DDG Extended Range Munition:** *Commander Kevin LaPointe*, USN, PEO/IWS 3, NAVSEA
- **Navy-Fire Scout (Vertical Takeoff & Landing Tactical UAV) & Scan Eagle Tier II Capabilities:** *Commander Robert Murphy*, USN Vertical Takeoff and Landing Unmanned Air Vehicle (VTUV), Integrated Product Team Lead
- **Navy-Shared Reconnaissance POD (SHARP):** *Captain Donald Gaddis*, USN, PMA-265
- **Marine Corps- Precision Artillery Systems: Expeditionary Fire Support System & the Towed Artillery Digitization System:** *Lieutenant Colonel Albert Lagore*, USMC, Fire Support Capabilities Integration Officer, Capabilities Development Directorate, Marine Corps Combat Development Command

***ACQUISITION TRANSFORMATION*:** *Ms. Eileen Giglio*, ADUSD for Strategic Plans & Initiatives to the DUSD (Business Transformation), OUSD (Acquisition, Technology and Logistics)

Office of the Deputy Under Secretary of Defense for Acquisition and Technology

The New Vision

25 April 2007

Precision Strike Association
Annual Conference

Vision

LEADERSHIP

for an

INTEGRATED, RESPONSIVE

ACQUISITION SYSTEM

providing

WARFIGHTER NEEDS

with

PREDICTABLE PERFORMANCE

“The Will To Change”

DoD/AT&L Goal Alignment

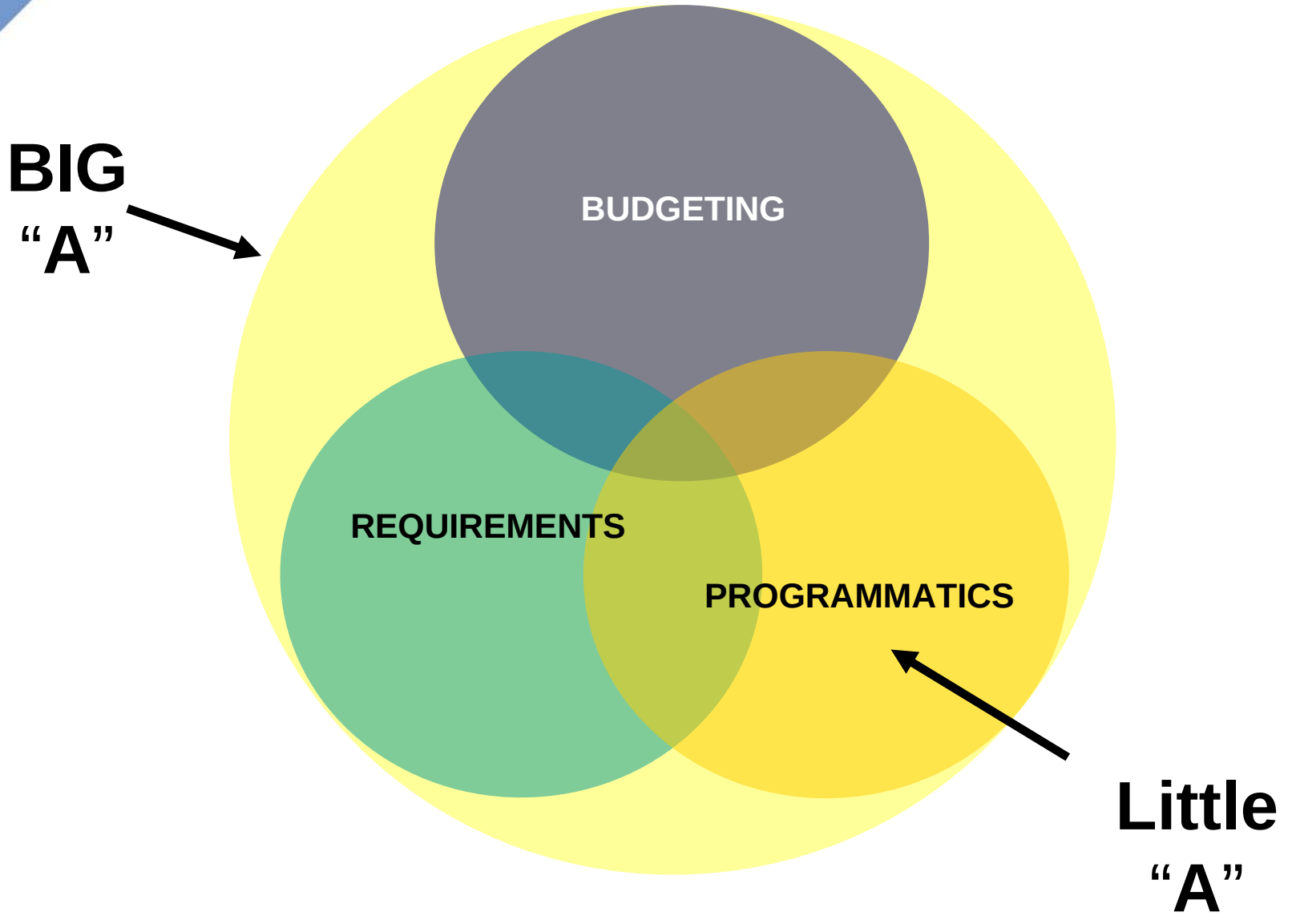
DepSecDef Goals:

- Win the Global War on Terror
- Strengthen U.S. Combined and Joint Warfighting Capabilities
- Meet the Challenge of Improvised Explosive Devices
- Continue Transforming the Joint Force
- Significantly Improve Military Intelligence Capabilities
- Focus on People – Military and Civilian
- Improve Effectiveness and Efficiency Across the Board

AT&L Goals:

1. High Performing, Agile, and Ethical Workforce
2. Strategic and Tactical Acquisition Excellence
3. Focused Technology to Meet Warfighting Needs
4. Cost-Effective Joint Logistics Support for the Warfighter
5. Reliable and Cost-Effective Industrial Capabilities Sufficient to Meet Strategic Objectives
6. Improved Governance and Decision Processes
7. Capable, Efficient, and Cost-Effective Installations

The Acquisition System



Complex System with Many Stakeholders

Strategy

RESHAPE THE ENTERPRISE

utilizing short and long term

INITIATIVES

that

ACCELERATE LASTING CHANGE

for all elements of the

ACQUISITION SYSTEM

Initiatives For Acquisition Excellence

STRATEGIC
"Big A"

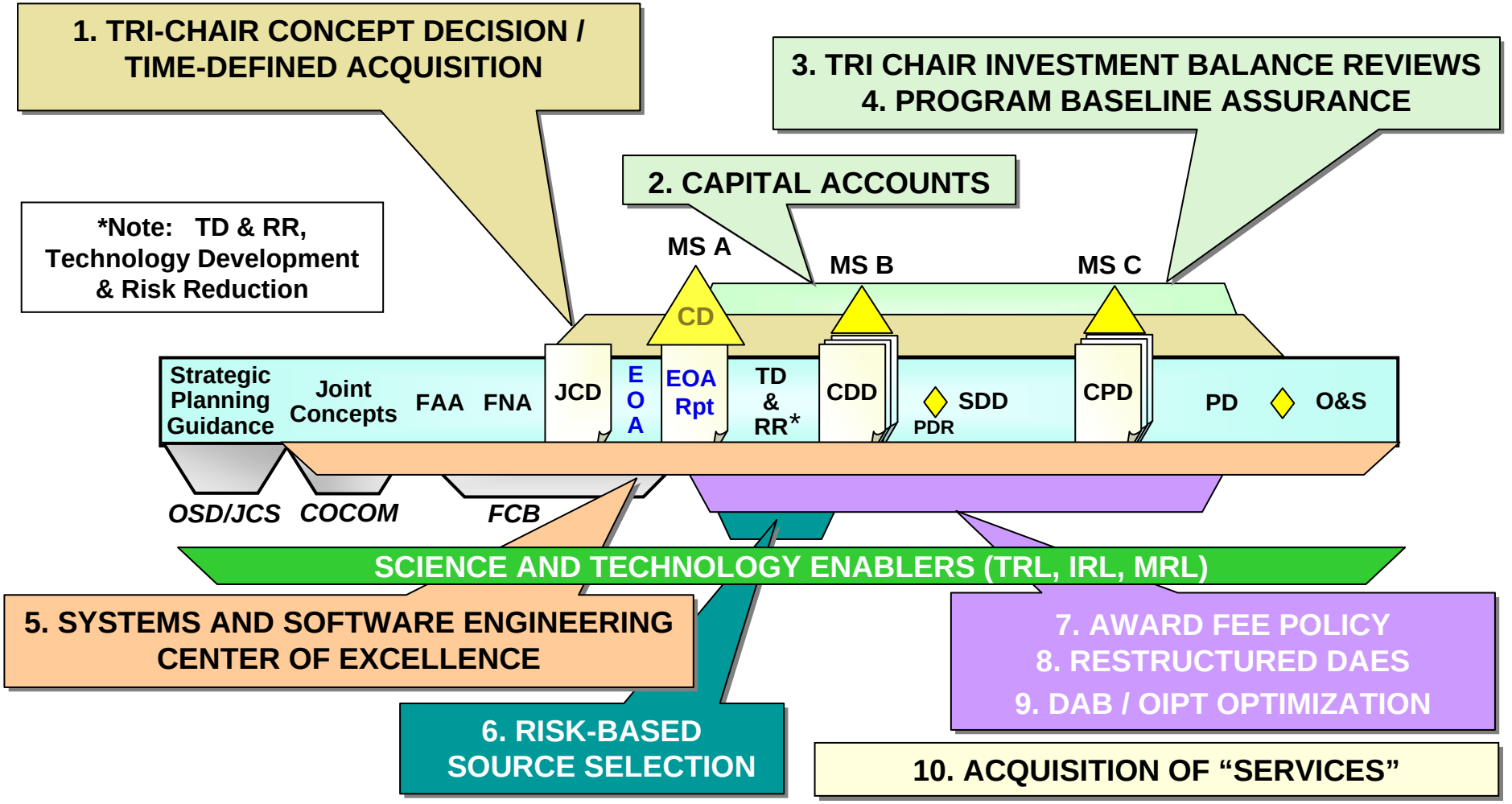
TACTICAL
"Little A"

OBJECTIVES	INITIATIVES
Strategic Decisions that Balance the Trade-Space – Affordable, Feasible Investments	• Portfolio Management • Tri-Chair Concept Decision / Time-Defined Acquisition • Evaluation of Alternatives (EOA) • Synchronize Existing Processes • Tri-Chair Investment Balance Reviews
Start Programs Right – Improved, Up-Front Planning – Awareness of Risk / Improved Source Selection – More Responsive Acquisition Solutions	• Risk-Based Source Selection • Small Business Innovative Research • Acquisition of Services Policy • Systems Engineering Excellence • Award Fee and Incentives
Improve Process efficiency – Tailored, agile, transparent	• DAB / OIPT Process Optimization • Common Data • Restructured Defense Acq Executive Summary
Improve Program Stability – No Downstream Surprises – Issue Awareness	• Program Baseline Assurance • Capital Accounts

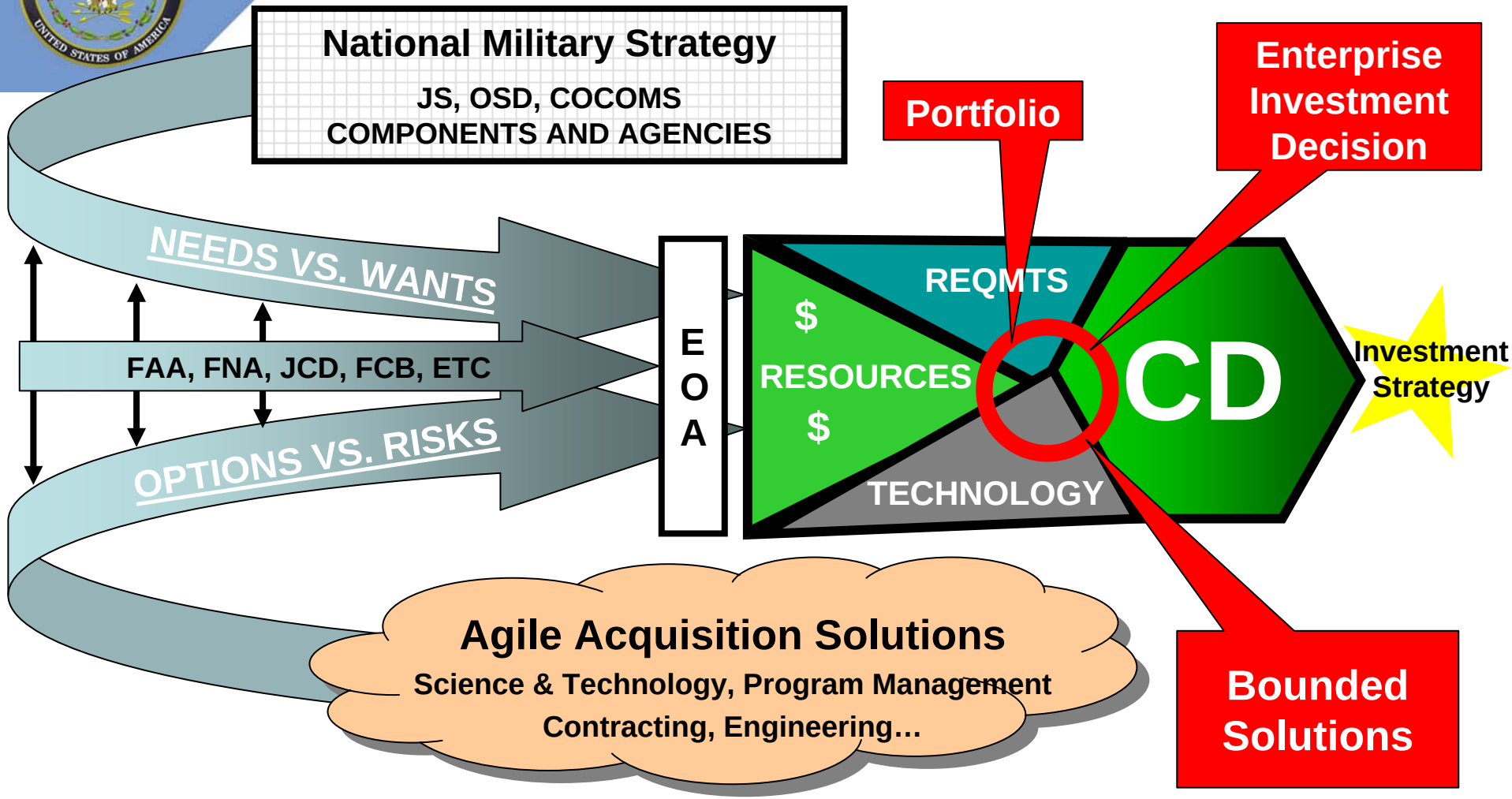
Improving the Full Range of Acquisition Execution

Acquisition Excellence

An Evolving Toolkit Reducing Cycle Time 50%



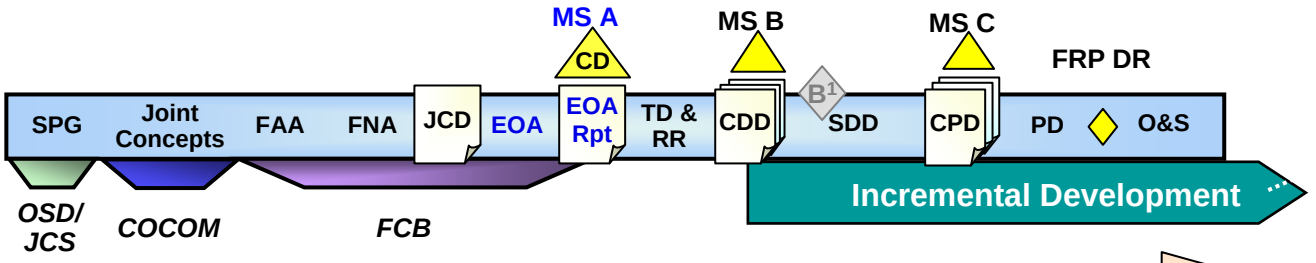
Concept Decision (CD)



QDR "Implement Now" Initiative
Strategic Choices - Balancing Capability, Risk, and Affordability
Leverage "Best Practices" via 4 Pilots (JLTM, IAMD, JRSG, GS-R)

Potential for Significant Savings

Improving Synergy with S&T



Science and Technology: Continuous throughout the lifecycle

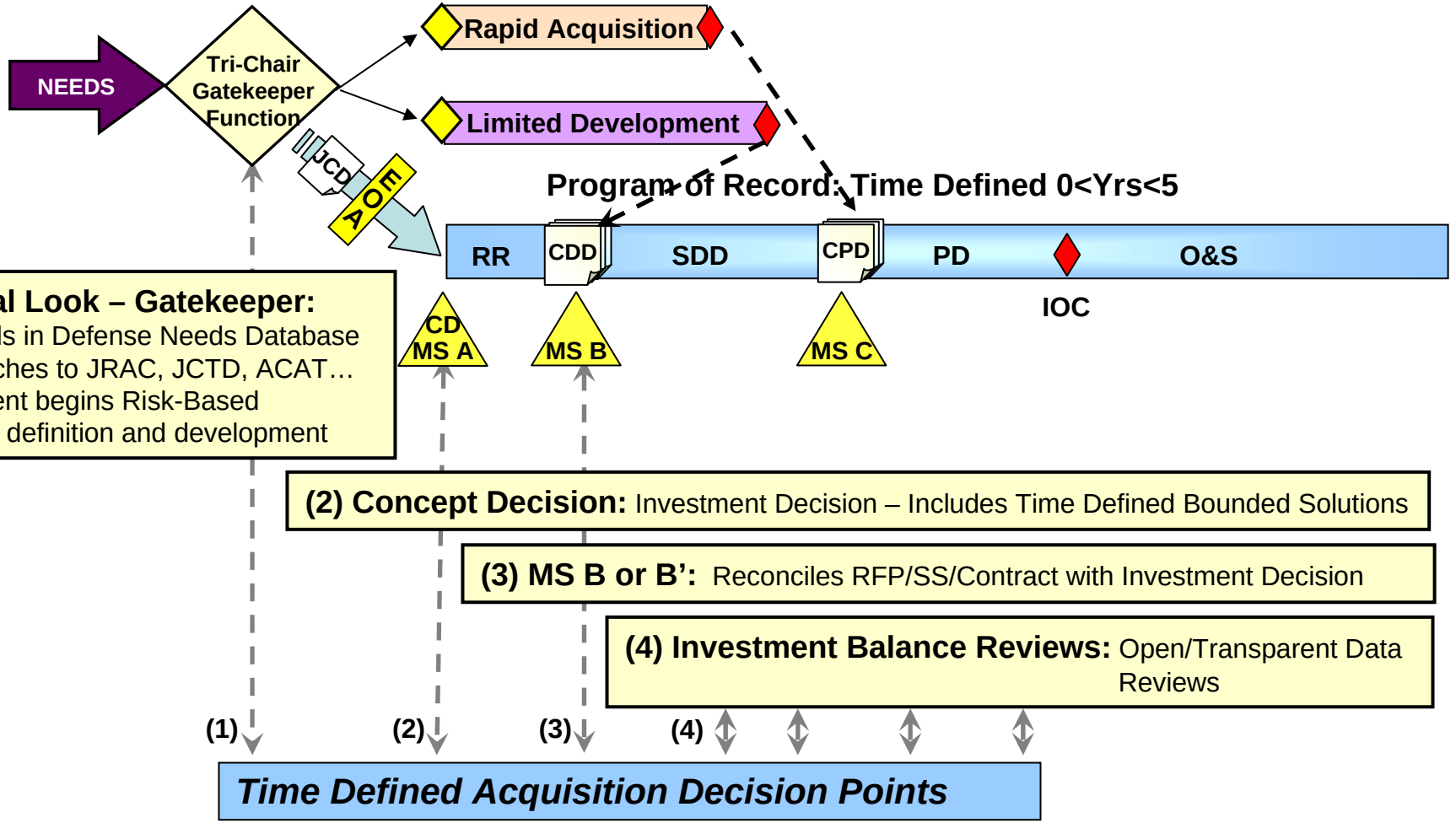
Technology Continuum – ON Ramps/OFF Ramps

- **Technology assessed during the Evaluation of Alternatives**
- **Technology matured in support of Risk-based Source Selection**
- **Mature technology transitioned for development; immature technology deferred to later increments**
- **Long Term technology investment considered during the Evaluation of Alternatives with bounded solutions**
- **Pull technology when ready – an Incremental/Block Approach**

Integrating Life Cycle Cost Metrics from the Get Go

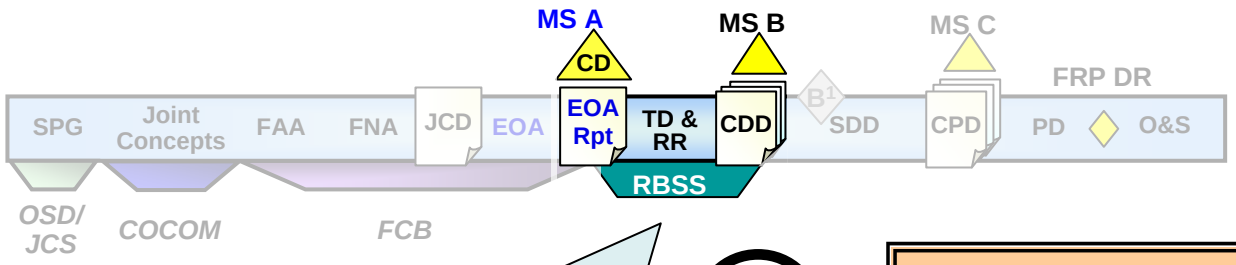
Time-Defined Acquisition

Defining an optimum path



Start Programs with Transition in Mind
Capitalize on Existing Processes and Decision Forums

Risk-Based Source Selection (RBSS)



Objective: Starting Programs Right

TRL 6+

More Knowledge

Less Knowledge

- Technology Maturation
- Requirements Stability
- Affordable Solutions
- Predictable Performance
- Risk Management

EOA

< TRL 6

Award SDD Contract

CD
MS A

TECHNOLOGY DEVELOPMENT & RISK REDUCTION

MS B

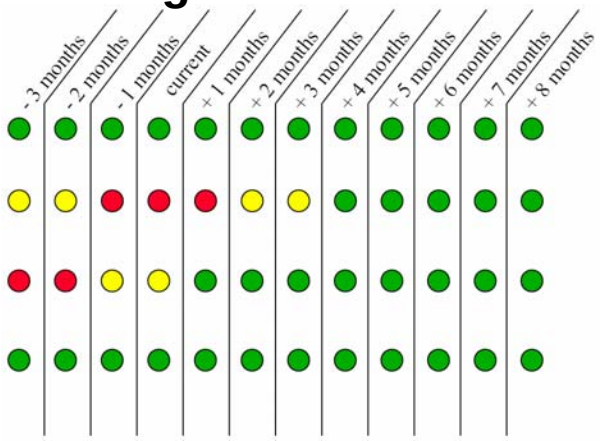
Identify, quantify and mitigate risk, stabilize requirements definition, refine cost estimation, and improve source selection decision making.

Restructured Defense Acquisition Executive Summary (DAES)

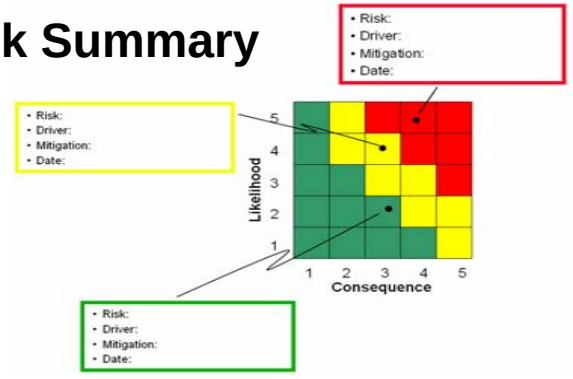
- **89 MDAP, ACAT1**
- **3 Star Level Review**
  - With USD(C), JS, PAE, SAE, PEO, PM
- **Simplify from 30 to 3 pages**
- **Utilize standard formats**
  - **Consistent tracking**
- **Transparency of Data**
- **Trade-off space considerations**
  - Start with Technical Performance
  - Schedule consideration, second
  - Trade-off Cost as a last resort
- **Known problems - closure 30/60/90 days**
- **Potential problems - risk mitigation plans**

Program Status

- **Cost**
- **Schedule**
- **Performance**
- **Funding**



Risk Summary



Issue Summary

No.	Issue / Problem Description	Action Plan	Closure Date
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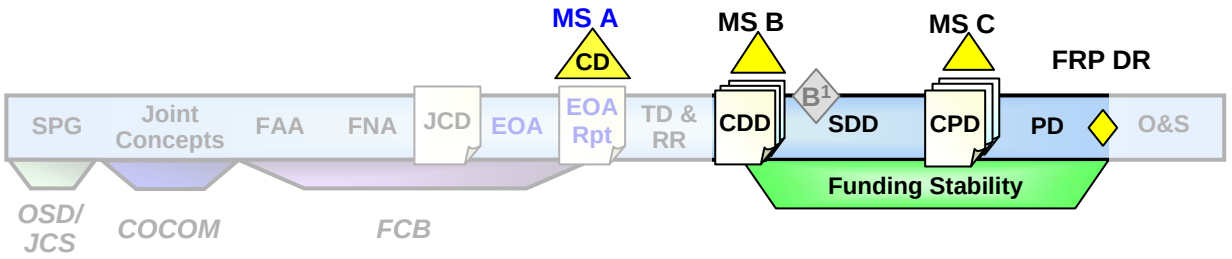
Objective: Program Stability
Improve the Process of Tracking Program Execution and Transparency

Funding Stability



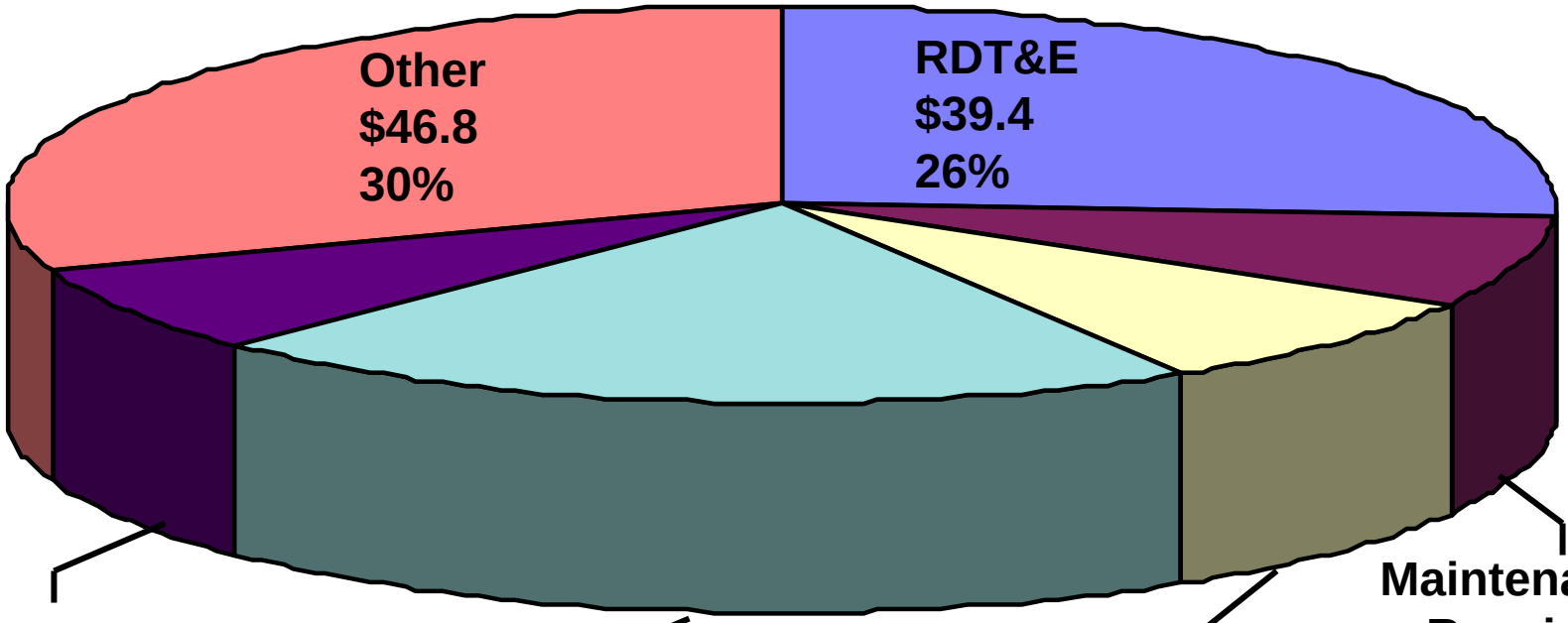
Capital Accounts

- **A financial initiative designed to provide stability in the budgeting system and to establish accountability for acquisition programs throughout the hierarchy of program responsibility**
- **Implements a risk-informed investment strategy reflecting joint warfighter priorities, and will be used to inform future investment decisions**
- **Consistent with the QDR and section 1004(a) of the FY 06 Authorization Act, the Department is exploring capital accounts to stabilize funding for selected major programs**
- **Pilot programs (MS B through MS C) to be established in the FY 2008 budget**
  - **Criteria established, agreement & metrics/performance measures to be developed for each pilot program**

Objective: Program Stability

FY 2006 DoD Spending on Services

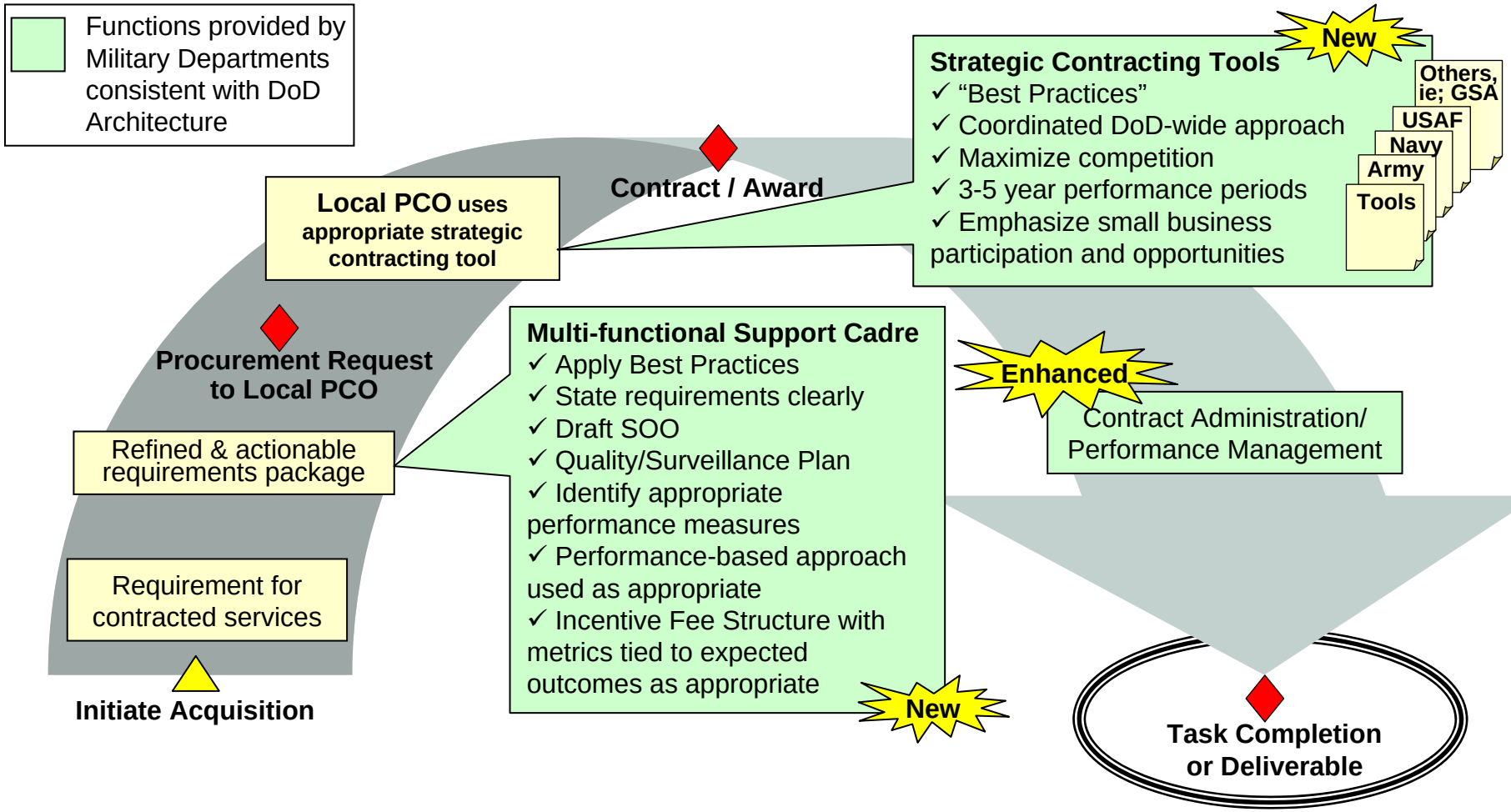
Total DoD Spend: $295 Billion
DoD Services Spend: $152.8 Billion



Acquisition of Services

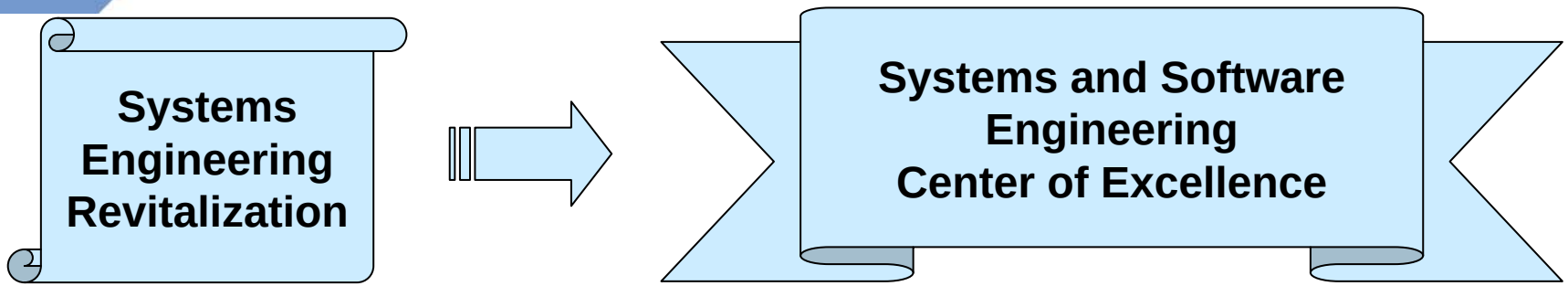
04-06-2007

Management Consistent with FY 06 NDAA Section 812



Potential for Significant Savings

Vision for Systems Engineering and Software



- **Competencies improved**
- **Delivered product suite**
  - Courseware
  - Policy/Guidance
  - Program Support methods
- **Elevated stature**
- **Raised awareness**
- **Positive influence**

- **World class leadership**
- **Broaden to Software Engineering, System Assurance, Complex Systems-of- Systems**
- **Responsive and agile, proactive to changing customer needs**
- **Focused technical assistance, guidance, and workforce education and training**

The Technical Foundation that Enables Acquisition Excellence

Why the Focus on Software…

Software is an increasingly, important factor

- **Research investment has been static or declining**
- **Requirements growth 10X from ’60s -’00s**
- **Need vs. skilled/clearable workforce - gaps increasing**
- **President’s Information Technology Advisory Committee Report, February 2005**
  - **Identifies SW as “major vulnerability”**
  - **Recommends priority attention**

Systemic issues are driving poor execution

- **Software requirements not well defined, traceable, testable**
- **Immature architectures, COTS integration, interoperability, obsolescence**
- **Development processes not institutionalized, planning documents missing or incomplete, reuse strategies inconsistent**
- **Schedule (un) realism - compressed, overlapping…**
- **Software risks/metrics not well defined, managed**

Vision of Success in 24 Months

Streamlined and Simplified Acquisition

- Reduced decision making cycle time
- Earlier initial operational capability

Affordable and Predictable Outcomes

- Bounded choices – trade space driven
- Open and transparent data and information management

Improved Centers of Excellence

- Systems and software engineering
- Program management / contract / pricing / cost expertise

Responsibility and Accountability Alignment

- Trust, integrity, and ethics as the cornerstones

Broadened Globalization, Innovation and Competition

- Characterized industrial base aligned to skills and strategy

Precision Strike Annual Programs Review

Sea and Land Strike Systems:

"Ship-to-Objective Maneuver enabling technology

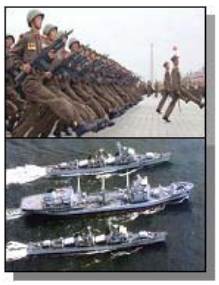
Captain Ed Barfield
Expeditionary Warfare Directorate (N85)
Amphibious Warfare Branch
25 April 2007

1

Strategic Landscape

- **The Irregular Challenges**
  - A global radical Islamist insurgency
  - Asymmetric warfare fought by decentralized groups
  - Exploitation of failed and failing states—intrastate conflicts

- **The Traditional Challenges**
  - Regional powers with conventional and (some) nuclear capability
  - Continued instability created by interstate conflicts

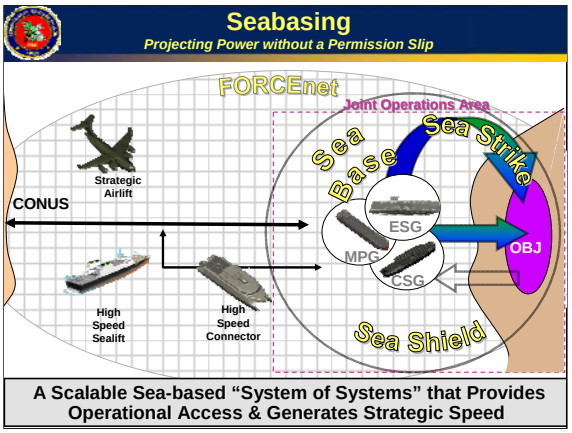


- **Naval Power Projection**…. takes the form of strikes employing bombs, missiles, rockets, and guns from ships and aircraft **and/or placing forces ashore**. (NWP 3-09)

Expeditionary Maneuver Warfare

Enabling Capabilities
C2
Force Protection
Intelligence
Logistics
Maneuver
Fires

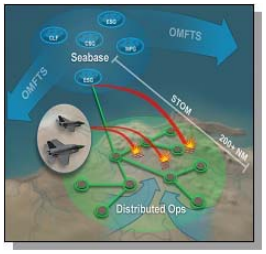
Fires
Massed Surprise Fires
Area Weapon
First Round Fire For Effect
Suppression/Neutralization/Destruction
Long Range Fires
Reduced Collateral Damage


Seabasing
Projecting Power without a Permission Slip
FORCEnet
Joint Operations Area
Sea Base
Sea Strike
Strategic Airlift
CONUS
ESG
MPG
CSG
OBJ
High Speed Sealift
High Speed Connector
Sea Shield
A Scalable Sea-based "System of Systems" that Provides Operational Access & Generates Strategic Speed

Distributed Operations

The Next Step in Maneuver Warfare

- Adapting our methods
- Remaining a flexible combined-arms force
- Enabling a generation of combat-experienced decision-makers by distributing authority

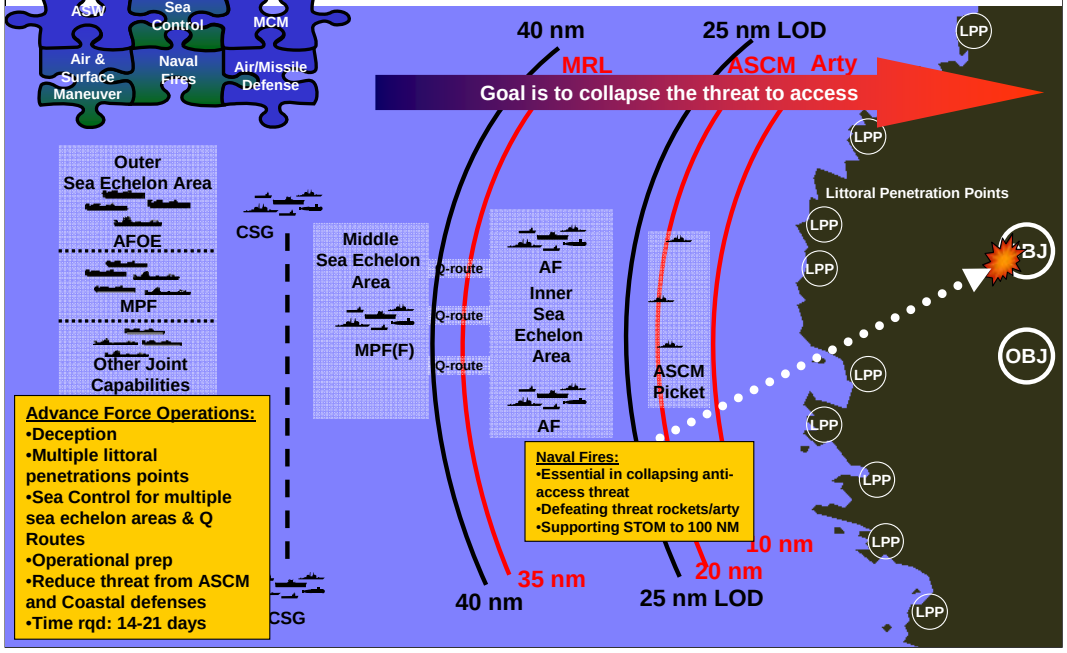


- Concept:
  - Create spatial & temporal advantage w/ new capacity for integrated action by physically dispersed units
  - Sense and act across an expanded battlespace
  - Distribute & reaggregate seamlessly
  - Design operations to dynamically link both concentrated and distributed forces
- Exploit:
  - Networked command & control
  - Joint & organic fires

5

Overcoming Military Threats to Access

Systems View: Sea Control and Expeditionary Power Projection



Expeditionary Operations

"Joint Fires In Support Of Expeditionary Operations in the Littorals"

Identified four capability gaps:

Gap 1: The capability to assign target-weapon pairing, provide target locations, target descriptions, and specify methods of fire

Gap 2: Ability to engage moving point and moving area targets under restricted weather conditions

Gap 3: Ability to engage known and/or identified targets when friendly forces are in close contact or when collateral damage is a concern

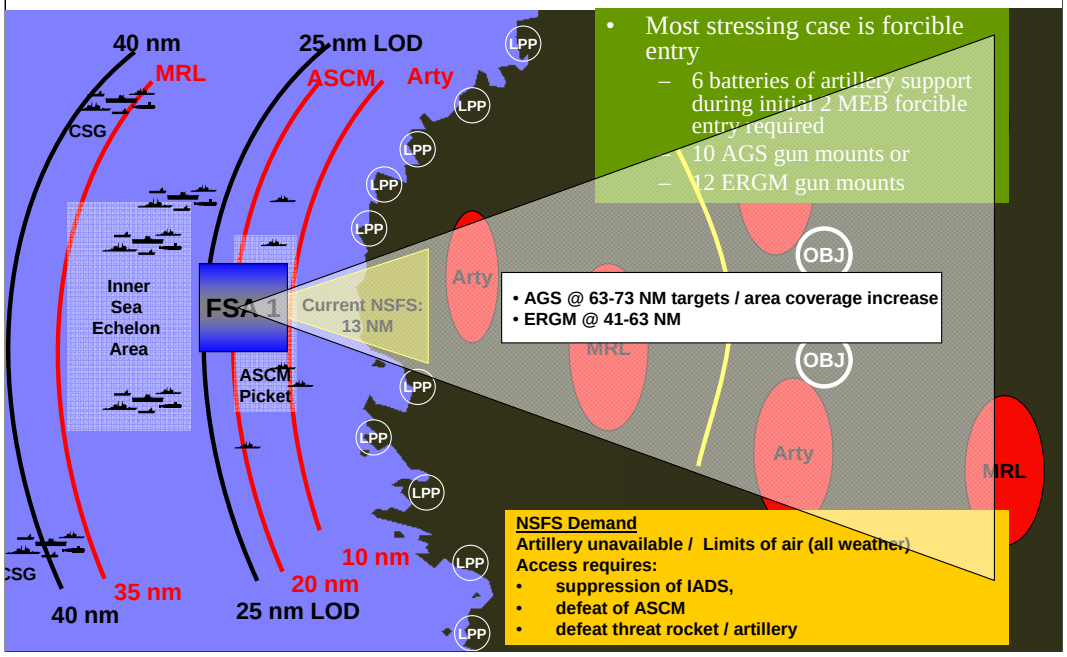
Gap 4: The capability to provide volume fires: a large quantity of fires on multiple targets over a short period of time, or a high density of accurate fires in a concentrated area to achieve the desired effects

"The chaos of the future requires … the capability to project power ashore … ranging from overcoming devastated infrastructure to assisting a friendly people in need of disaster relief to countering the entire spectrum of armed threats."

- OMFTS, 1996

Naval Combined Arms Requirement

All-weather, 24 / 7 responsive fires during littoral operations, initial assault, and operations ashore



Challenges & Answers

- **Challenges:**
  - **Anti-access obstacles require power projection from over the horizon.**
  - **Artillery not available during initial assault; limited during initial inland operations**
  - **Limits of air (all weather)**
  - **Conventional NSFS is limited by range (13NM) and effect**
  - **Access requires suppression of IADS, defeat of ASCM and rocket / artillery threat**
- **Answers:**
  - **All-weather, 24 / 7 responsive fires during initial assault, littoral operations, and operations ashore**
  - **Combined arms is a required capability for power projection**
    - **Tactical Aviation**
    - **Sea-Based Fires**
    - **Ground Based Fires**

9

NLOS-LS
Non-Line of Sight Launch System

NLOS-LS Overview

- Program is on track
- NLOS-LS fully funded in the POM 08-13
- Recognized as a critical capability
- Fielding to Army Evaluation Task Force in 2008 with Spin out 1- full fielding starting in 2010.

NLOS-LS
SO1 System Components

NLOS-LS Capability

Precision Attack Missile (PAM)

- 40 km range
- Automatic Target Acquisition
- Laser Guided and GPS engagement modes
- Sealed canister – "Wooden round"
- Missile in canister less than 163 pounds

Computer and Communication System (CCS)

- Computes Technical Fire Data
- Manages Missile Launch
- C4I:
  - Compatible with Current and Future Tactical Radio Systems
- Self-Location and Orientation
- Self-Powered via Battery

CCS

CLU

Container/Launch Unit (CLU)

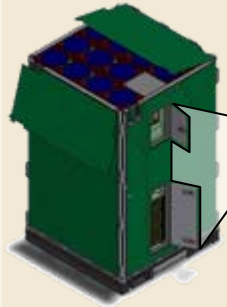
- Contains 15 Missiles and CCS
- Transportable by Air (C-17, C-130, V-22, UH-60, CH-47) Ground (FMTV and Other Vehicles) and Shipboard
- Not Platform Dependent
- Remotely or Locally Operated
- Weight Approx 3150 lbs (with Missiles)

Container/Launch Unit (CLU)

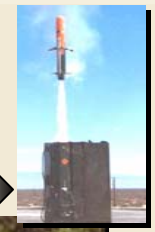
Threshold Capabilities:

- ✓Not Platform Dependent
- ✓Self-Locating to 10 meters
- ✓C-130 Roll-on/Roll-off
- ✓Vertical Launch
- ✓20 Second Response Time
- ✓72 hour Battery Life
- ✓Reconfigurable

Tamper Resistant



CCS



CLU Contains 15 Missiles, Battery, Fire Control and Communications System

PAM

GPS/INS Navigation System

Data Link
- Network Radio
- JTRS Surrogate
- Software Progr

Automatic Target Acquisition (ATA)

Requirement	ORD Threshold
Maximum Range	40 km
Minimum Range	500m
Target Set	High Value Targets
Updates in Flight	2-Way Network Comms

Multi-Mode Seeker
- Infrared (IR)
- Laser Guided

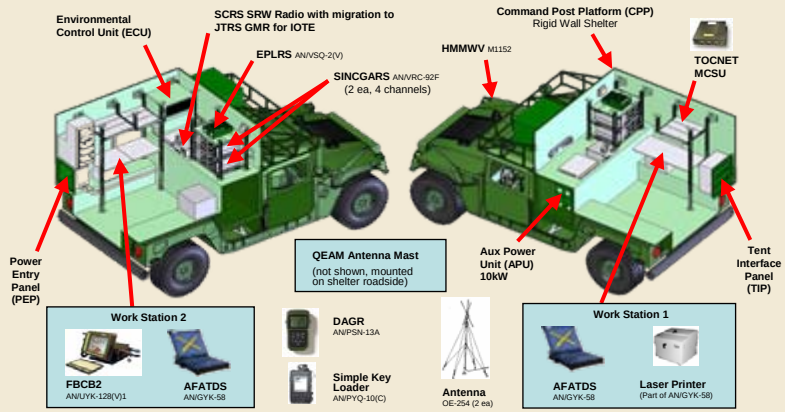
Laser Guided PAM

IR Image

IR Image

PAM Provides A 40km Precision Kill Capability Against Moving Targets Using Laser Guidance or Automatic Target Acquisition

Control Cell

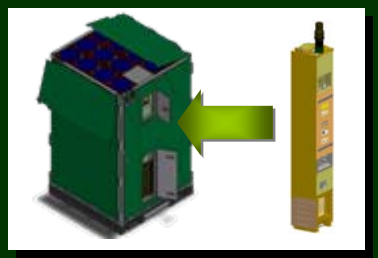


The Control Cell Provides NLOS-LS Future Force Capability To Modular and Current Force Organizations

Container/Launch Unit (CLU)

Capabilities

- **Network Radio/Node**
- **15 Missiles**
- **C-130 Roll-On/Roll-Off**
- **Not Platform Dependent**
- **Self Aligning, Self Locating, Reloadable, Reconfigurable**
- **Determines Vertical, North and GPS Location**



Requirements

Function / Component	Remarks
Container/ Launch Unit (CLU)	• Not Platform Dependent • Dimensions: Ht ~69", LxW 45", Wt ~3150 lbs • Remote and Local Launch Operations • On-Board Technical Fire Control • Intrusion Detection • Self-Diagnostics: Performed on Entire System Upon Utilization and Afterwards On-Command
Strategic Mobility	• Air: C5, C-17 • Sea: RO/RO; Container Ship; Break Bulk
Operational and Tactical Mobility	• Air: C-130, CH-47; UH-60, V-22 • Ground: FMTV, HEMTT
C2	• Organic to HBCT and NLOS Battalion • JTRS Surrogate Radios • GPS Anti Jam and SAASM compliant • Current Force (AFATDS) and Planned Compatibility with Battle Command System

Precision Attack Missile (PAM)

Capabilities

Length: Allows C-130 RO/RO
Weight: Each Missile in Canister Less than a Two-Man Lift


MBT Defeating Warhead

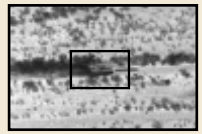

Boost/Sustain Propulsion


MEMS IMU


Network Radio


IR Seeker (640x480 Array)


Moving Target Tracker


Automatic Target Acquisition


SAASM GPS

- Target Image Prior to Impact Supports Battle Damage Assessment
- Multiple Seeker Modes Provide Target Acquisition Performance Under a Wide Variety of User Defined Tactics, Techniques and Procedures

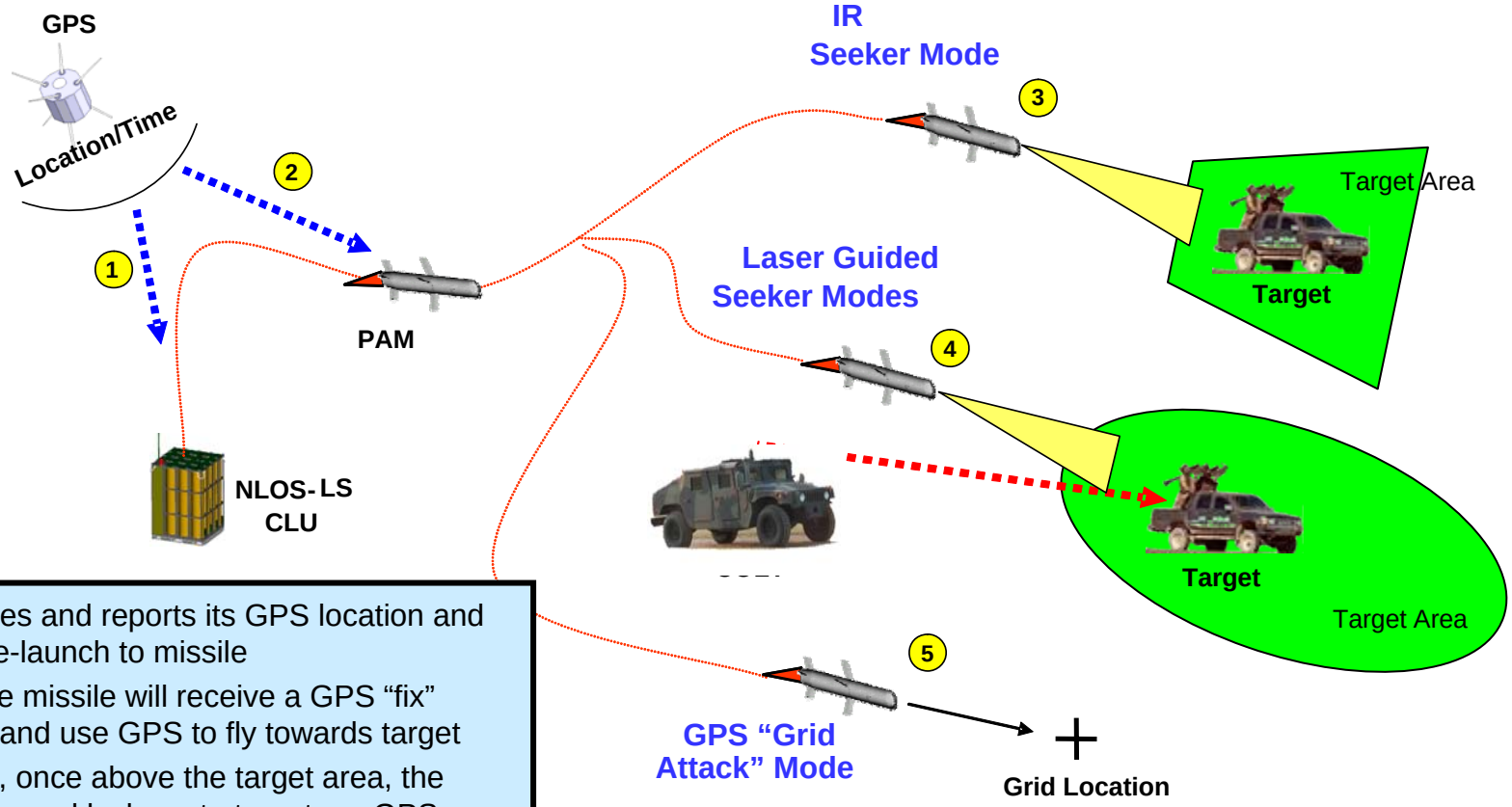
Flexible Engagement Options

IR Mode	Laser Designate Mode
• Observer provides Target Location and Target Type • Moving targets may require update of target location • IR Seeker selects Target and Best Aimpoint	• User Designation of Selected Targets in Cluttered Environment • User Designates Impact Point • Works with Airborne and Ground Based Designators • System Will Always Guide Off of Laser Returned, If Detected
Laser Anoint Mode	**Laser Offset Mode**
• Uses both IR and Laser Seekers • Laser Cues Missile to Attack Desired Target • IR Seeker Selects Best Aimpoint • Default Mode for Moving and Stationary Vehicles	• Similar to Laser Anoint Mode Except Laser is Used to Designate an Object in Close Proximity to Target • IR Seeker Selects Target/Aimpoint • May Avoid Triggering Laser Warning Receivers

Requirements

Length:	**67” (with Canister)**
Diameter:	**7”**
Weight:	**162.5 lbs (with Canister)**
Range:	**Approximately 40 Km+**
Altitude:	**Variable, Non-Ballistic**
Velocity:	**Subsonic**
Seekers:	**IR and Laser Guided**
Warhead:	**Shape Charge/Blast Frag**
Guidance:	**GPS/INS**
In Flight Update:	**For Moving Target Location**
Employment:	**Moving and Stationary Targets**

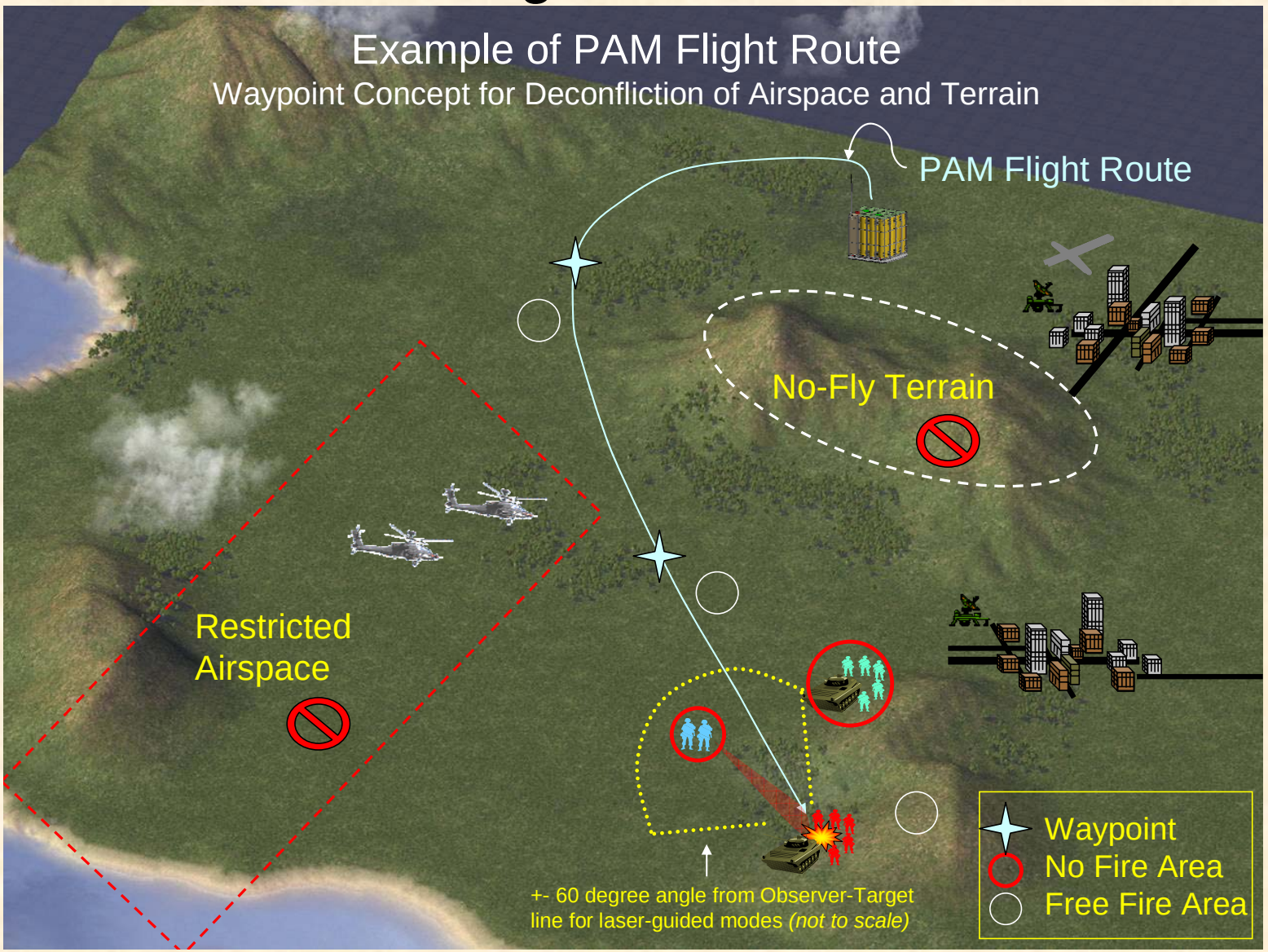
PAM Seeker Modes

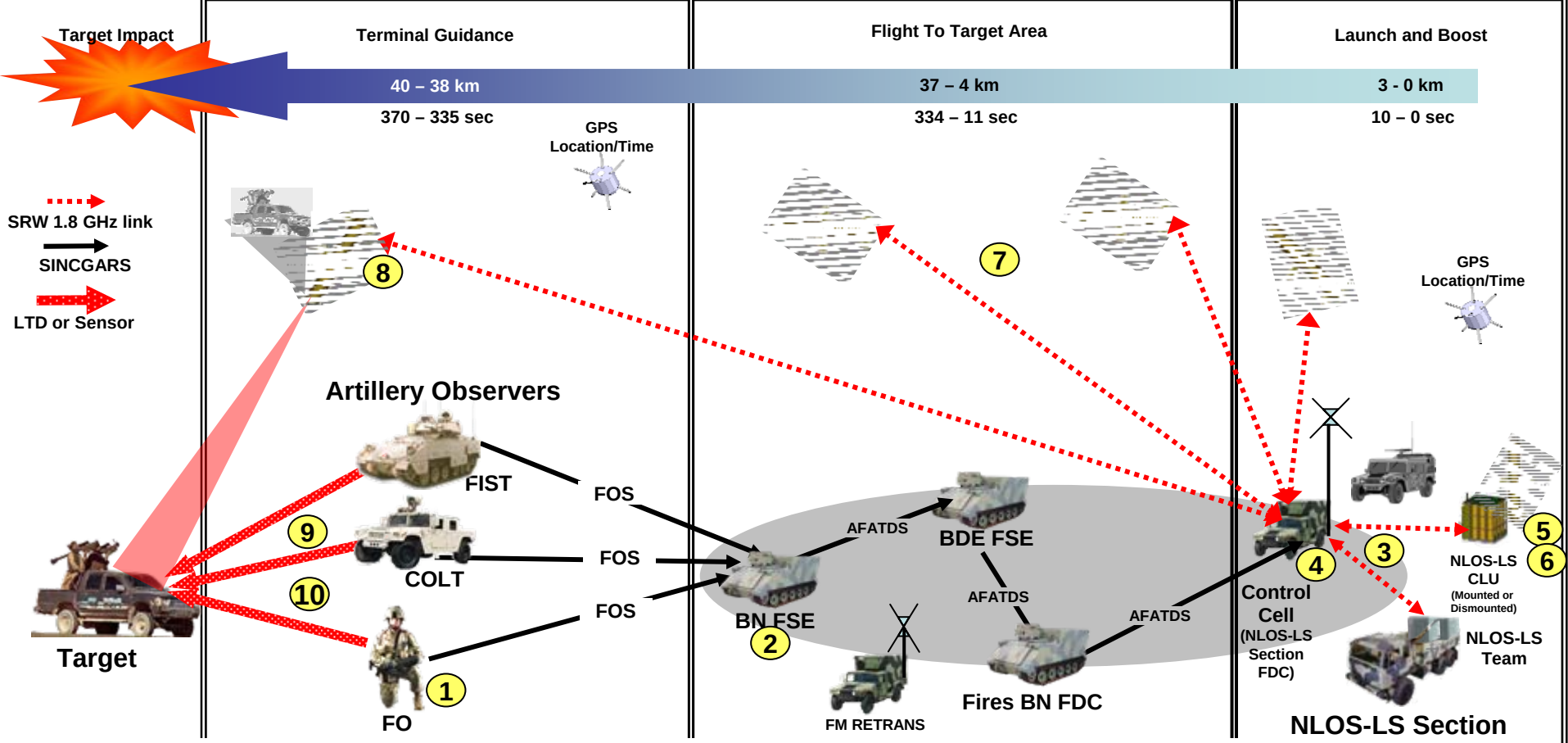


1. The CLU establishes and reports its GPS location and passes Attitude pre-launch to missile
2. Once launched, the missile will receive a GPS "fix" within 15 seconds and use GPS to fly towards target
3. In IR seeker mode, once above the target area, the missile searches for and locks onto target: no GPS needed now
4. In Laser Guided seeker modes, the missile searches for reflected laser energy from designator (3 modes: Designate, Anoint and Offset)
5. In GPS "Grid Attack" mode, the missile uses GPS signals received in-flight to fly directly to specified grid location and detonate on impact

PAM's Multiple Targeting Modes Increase Flexibility, Improve Lethality

Waypoints for PAM Flight Path





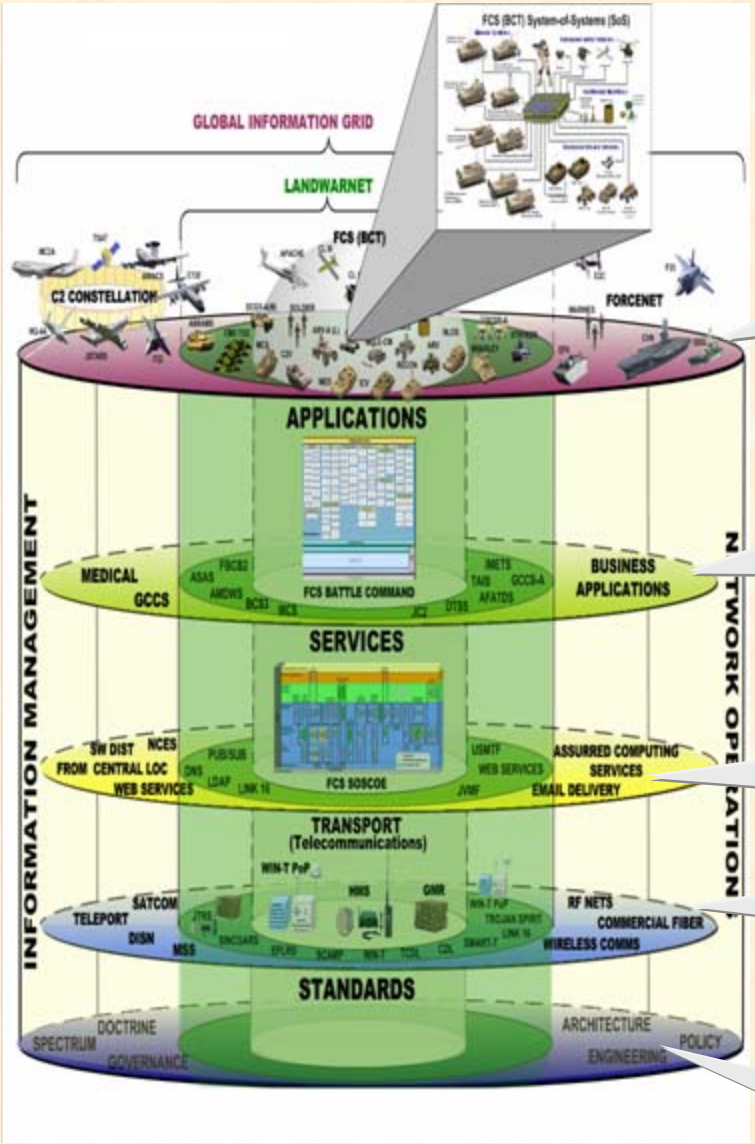
NLOS-LS Concept of Employment for Spin Out 1 / Modular Force

SEQUENCE:

1. Observer sends a Call for Fire to the Maneuver Battalion FSE AFATDS. **(FOS to AFATDS via SINCGARS)**
2. Battalion FSE AFATDS processes the fire mission and sends a Fire Mission thru BDE and Fires Battalion FDC to the NLOS-LS CC AFATDS **(AFATDS to AFATDS to AFATDS via SINCGARS)**
3. NLOS-LS CC AFATDS processes the fire mission and sends a Fire Mission to CLU(s) that it directly controls **(AFATDS to CLU via SRW)**
4. CC AFATDS sends Observer response message to the Bn FSE AFATDS who forwards the message to the Observer **(AFATDS to FOS via SINCGARS)**
5. CLU fires the mission and sends a "Shot" message to the AFATDS which forwards it to the Observer. **(CLU to AFATDS via SRW then FOS via SINCGARS)**
6. CLU sends an operational status including rounds remaining to the CC AFATDS. **(CLU to AFATDS via SRW)**
7. PAM sends position reports to the NLOS-LS CC AFATDS during flight. **(PAM to AFATDS via SRW)**
8. NLOS-LS CC AFATDS relays the "Designate" command from PAM (only on Laser guided missions) to the FO/COLT/FIST to laze the target prior to impact. **(AFATDS to FOS via SINCGARS). AFATDS and FOS also have internal countdown timers for redundancy.**
9. Observer lazes the target for the PAM to acquire (only on Laser guided missions).
10. Observer sends an End of Mission & Surveillance to the AFATDS **(FOS to AFATDS via SINCGARS)**

NOTE: FM Retrans deployed by battalion to fill SINCGARS network gaps for voice and data.

FCS Layered Network Architecture



Platforms & Sensors

Suite of ground/air, manned/unmanned platforms, with a diverse set of sensors tailored to the warfighters needs

Applications

Battle Command and Control, Intelligence, Surveillance, and Reconnaissance (ISR), Embedded Training, and Sustainment

Services

Common toolset of infrastructure services, (i.e. information assurance, interoperability, etc.)

Transport

Multi-Tiered (Ground, Air, Space), Dynamic, On the Move Communications Network

Standards

Common set of standard to enable interoperability and end-to-end performance metrics

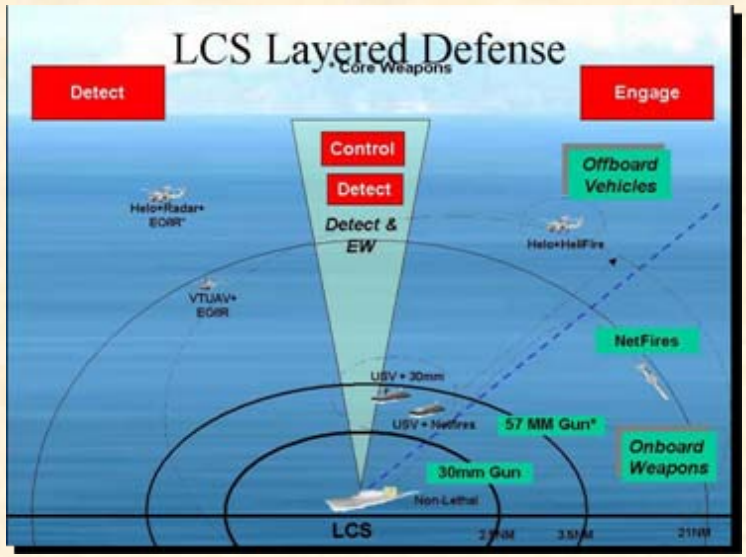
Video

Sling Load

Navy

MISSION: Defend Against Small Boat Threat

PAM Seeker Captive Flight Test, Wallops Island; November 2004



NLOS-LS Modularization for Littoral Combat Ship

Challenges

- Accelerating this capability and fielding in Spin Out 1
- Developing doctrine, organizations to implement outside FCS BCT
- Maintaining support for Army modernization
- Sustaining support for precision systems at maneuver brigade level

BACKUP

Computer and Communication System (CCS)

North Finding Module

Antenna

Navigation Unit

Removable Control Panel

Computer and Electronics Unit

Power Source

Weapon I/O Cage

Power Distribution Module

Characteristics

- Manages Missile Launch
- C4I
  - Compatible with Current and Future Tactical Radio Systems
  - Remote (Through AFATDS) and Local Operation
  - Planned Integration with FCS Battle Command System
- Self-Location & Orientation
- Self-Powered via Battery
- Facilitates Transfer of Power and Data Between Multiple CLUs

CCS is a Complete, Self Contained Fire Control System

M1084A1 FMTV

5 Ton Resupply Vehicle (RSV)

- Manufactured by Stewart & Stevenson
- Same vehicle as HIMARS Resupply Vehicle (RSV)
- Two Man Crew
- C-130 / C17 Transportable; USAF Certified
- Carries 2 CLUs
- On-board Materiel Handling Equipment: 5500 lb capacity crane
- Can be fitted with variety of cabs

NLOS-LS Control Cell for SO1 HBCT

SCRS SRW Radio with migration to JTRS GMR for IOTE

Environmental Control Unit (ECU)

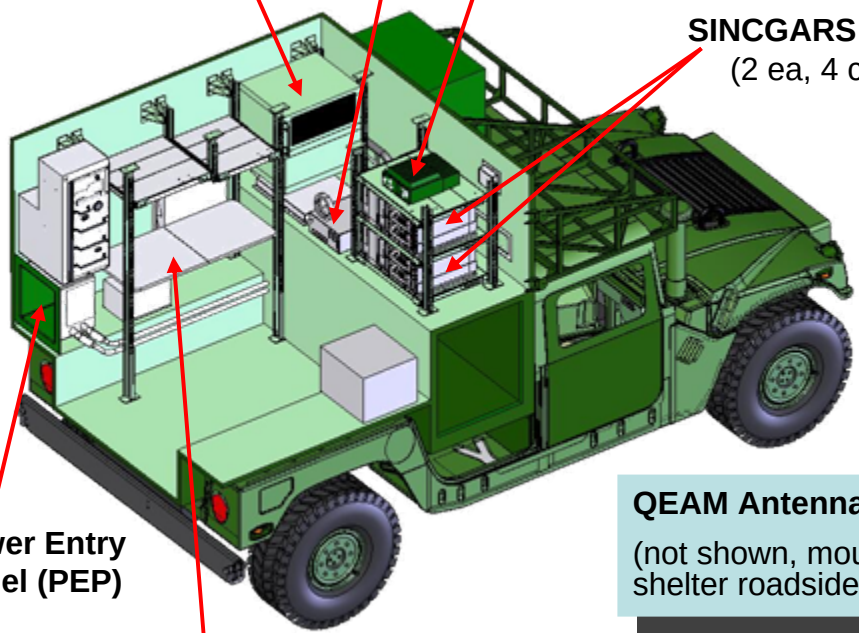
EPLRS AN/VSQ-2(V)

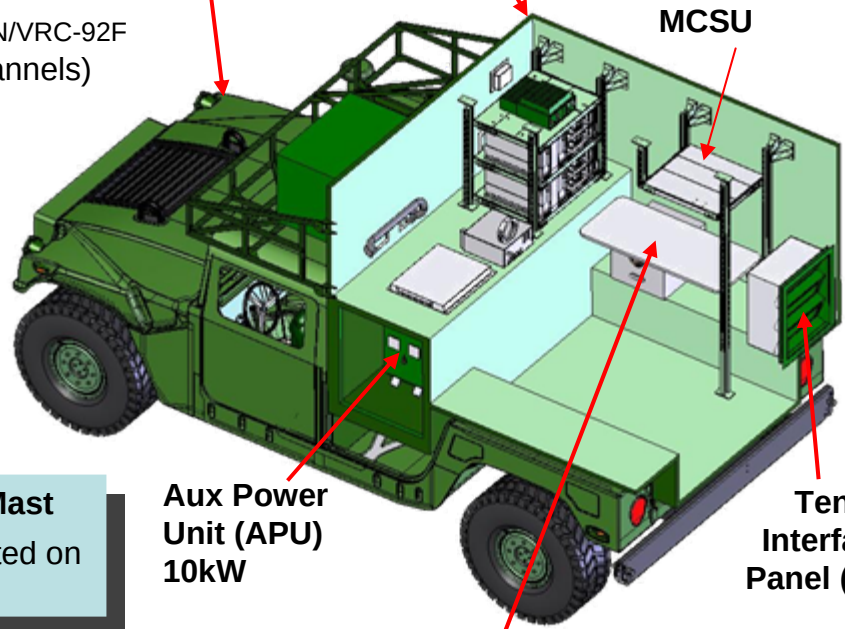
SINCGARS AN/VRC-92F (2 ea, 4 channels)

Command Post Platform (CPP)
Rigid Wall Shelter

HMMWV M1152

TOCNET MCSU





Power Entry Panel (PEP)

QEAM Antenna Mast
(not shown, mounted on shelter roadside)

Aux Power Unit (APU) 10kW

Tent Interface Panel (TIP)

Work Station 2

FBCB2
AN/UYK-128(V)1

AFATDS
AN/GYK-58

DAGR
AN/PSN-13A

Simple Key Loader
AN/PYQ-10(C)

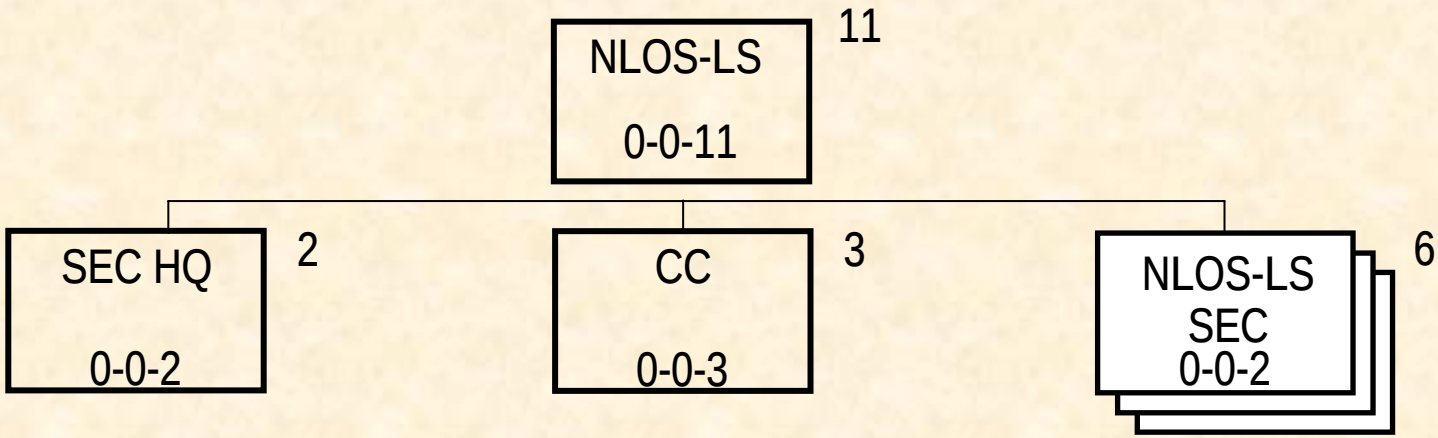
Antenna
OE-254
(2 ea)

Work Station 1

AFATDS
AN/GYK-58

Laser Printer
(Part of AN/GYK-58)

Fires BN, NLOS-LS Section



Section HQ

13D40	E7	SECTION SGT	1
13D10	E4	VEHICLE DRIVER	1

Major Equipment

C18378	CO SET AN/UYK-128(V)1	1
N05482	NIGHT VIS AN/PVS-7B	2
P49587	AN/VSQ-2C (V) 2	1
R45543	RADIO SET AN/VRC-92F	1
T11588	TRK UTIL M1152 EXP	1
T95924	TRL CGO: HI MOB 11/4T	1

Control Cell

13D30	E6	SQUAD LEADER	1
13D20	E5	FIRE CONTROL NCO	1
13D10	E4	AFATDS OPERATOR	1

Major Equipment

A79381	ANTENNA GRP OE-254	2
C18004	COMP ST AN.GYK-58	1
C18378	CO SET AN/UYK-128(V)1	1
C05541	CTR REC C-11561(C)/U	1
D78555	D T D ANCYZ-10 V3	1
N96248	NAV ST: GPS PSN-13A	1
N05482	NIGHT VIS AN/PVS-7B	2
P49587	AN/VSQ-2C (V) 2	1
R45543	RADIO SET AN/VRC-92F	2
R98145	RIGID WALL SHELTER	1
T11588	TRK UTL M1152 EXP CAP	1
Z00000	JTRS CLUSTER 1 GROUND	1

NLOS-LS Sections x3

13B20	E5	TEAM LDR	1
13B10	E4	DRIVER	1

Major Equipment x3

C05541	CTR REC C-11561(C)/U	3
C18378	CO SET AN/UYK-128(V)1	3
D78555	D T D ANCYZ-10 V3	3
N05482	NIGHT VIS AN/PVS-7B	6
P49587	AN/VSQ-2C (V) 2	3
R45543	RADIO SET AN/VRC-92F	3
T41203	M1084A1 FMTV TRK	3

NLOS-LS Section

NLOS-LS Section Leader
1x M1151 HMMWV
1x M1102 ¼ ton trailer

13D40
E7 Section Ldr

13D10
E3 Veh Dvr

Control Cell
1x M1113 HMMWV with rigid wall shelter

13D30
E6 CC Chief

13D20
E5 Fire Control NCO

13D10
E3 AFATDS Opr

13B20 X 3
E5 Team Ldr

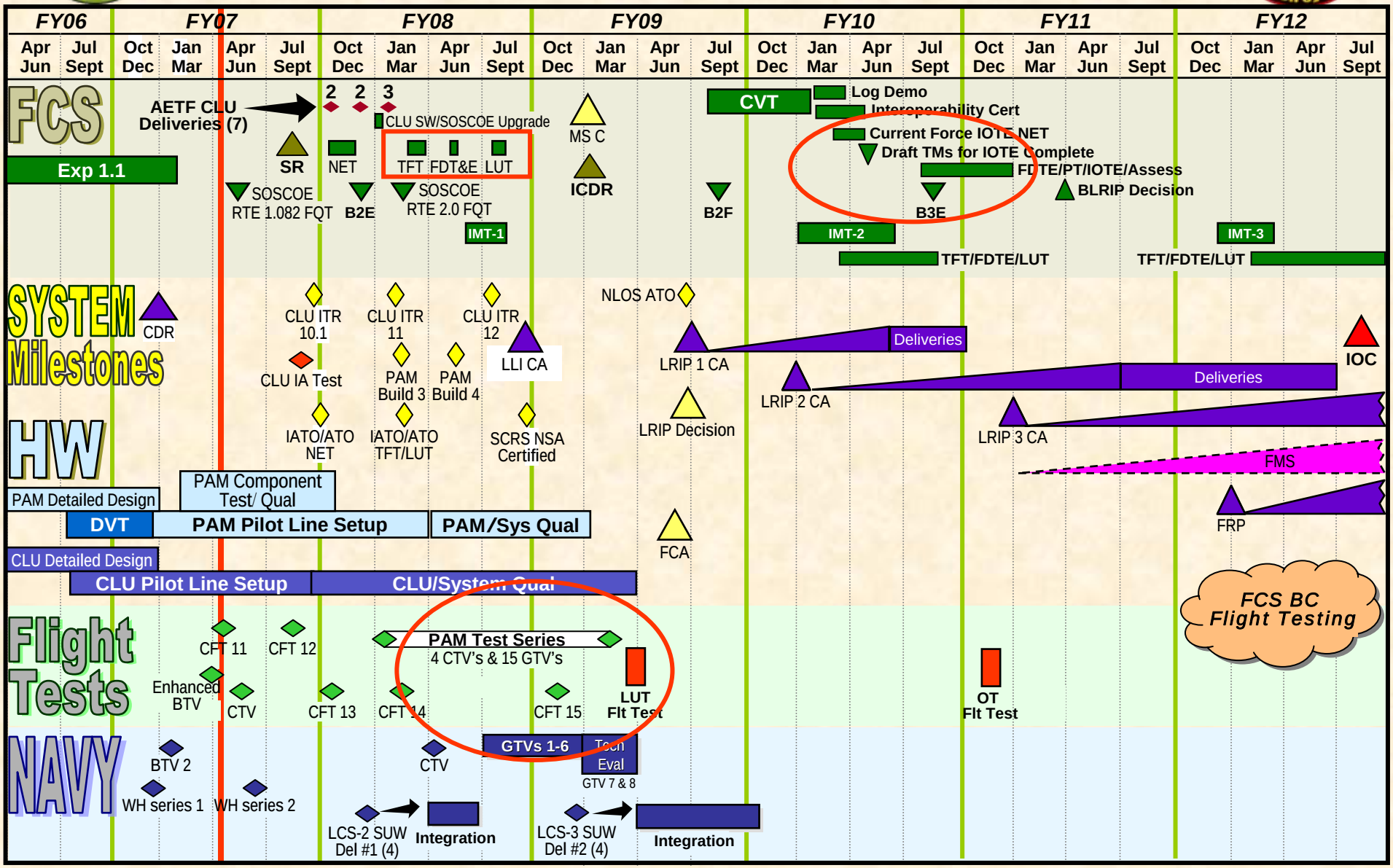
13B10 X 3
E3 Veh Dvr

Team 1
1x M1084A1R FMTV
2x CLU

Team 2
1x M1084A1R FMTV
2x CLU

Team 3
1x M1084A1R FMTV
2x CLU

NLOS-LS Schedule



Challenges

- Management of Requirements across numerous organizations
- Software development schedule to meet Spin Out testing requirements
- Facilities to support Institutional Training

Critical Joint Issues for Precision Engagement

Mr. Doug "Butch" Cassidy
Joint Fires Division J85
U.S. Joint Forces Command

"We are extremely effective at hitting what we're aiming at. . ."

Abu Musab al-Zaqawi

"Are we aiming at the right thing?"

News

Joy at direct hit turns to horror

Horror ... Matty, left, died in an armoured vehicle hit by US tankbuster like the ones pictured, right. Centre pictures show killer pilot's view as he attacked Brit convoy twice, despite markings showing they were friendly troops

Right picture: REUTERS

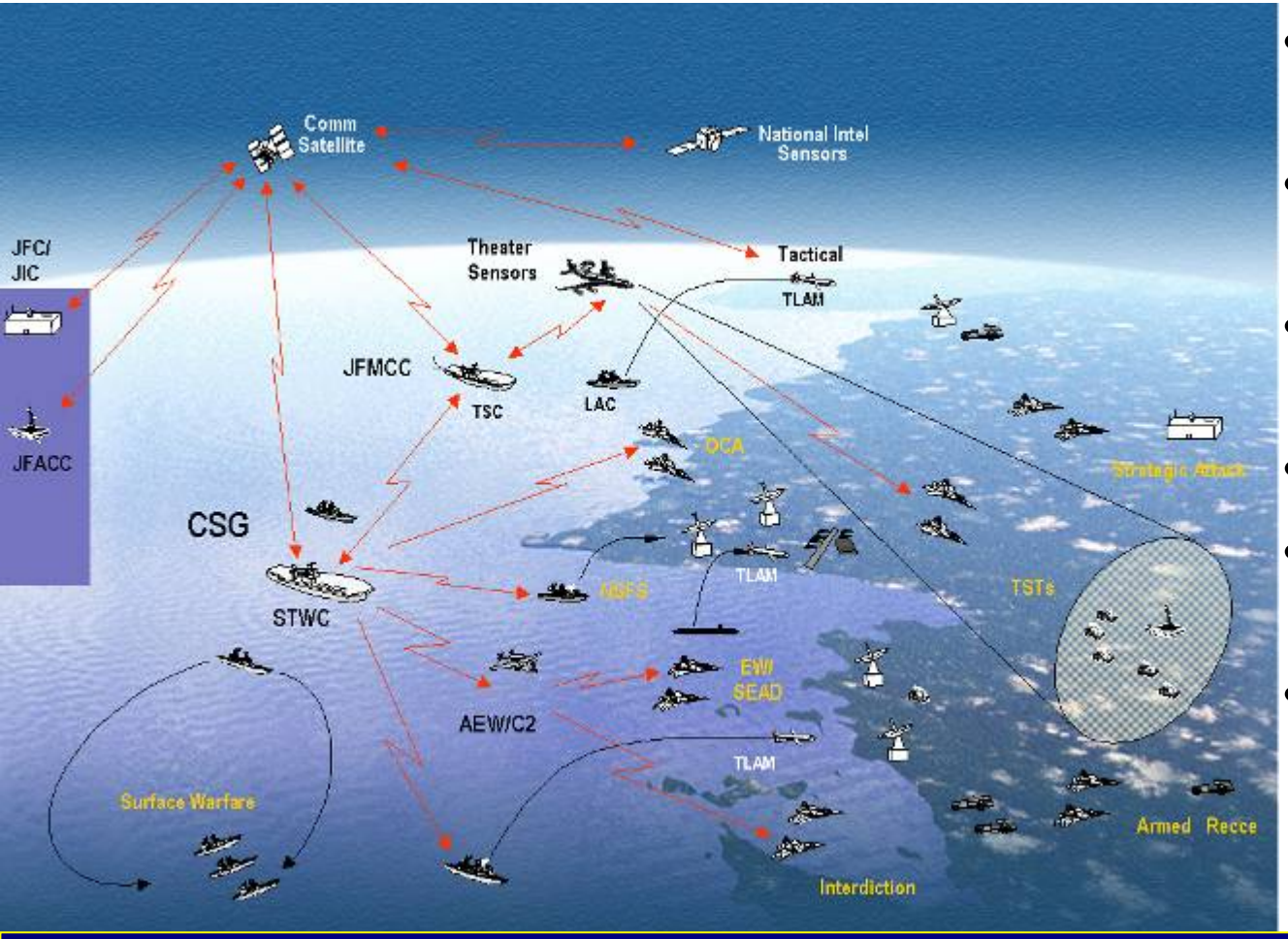
"Minimizing ambiguity (CID) & building situational awareness is the heart of Precision Engagement"

Overview

- Net-Enabled C2, Precision Engagement Environment
- Combat Identification
- Joint Capability Developer

21st Century Warfighting

Full Spectrum Dominance



- **Fully Integrated Joint Decisive Operations**
- **Effects-Based Approach**
- **Network-Centric Operations**
- **Decision Superiority**
- **Global Battlespace Perspective**
- **Adaptive Force Application**

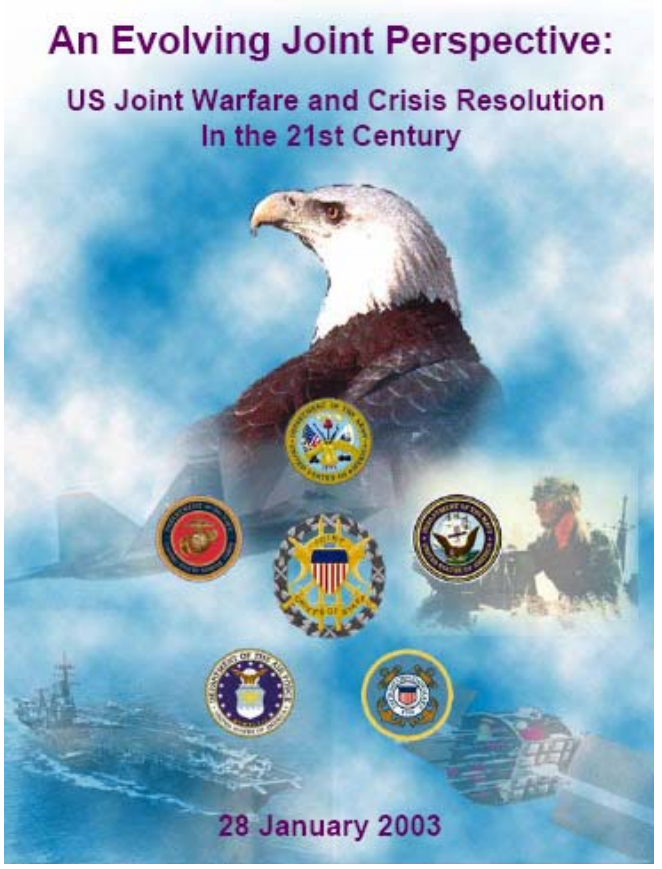
Enabled By Network Centric Environment

Warfighter Requirements

Global Strike Joint Integrating Concept

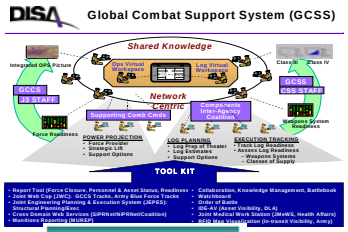
"Must be able to engage the full range of fixed, mobile, time sensitive, and specialized targets (including C2 nodes, leadership, WMD/WME), in all weather conditions."

- **OEF/OIF Lessons Learned**
- **Quadrennial Defense Review**
- **Strategic Planning Guidance**
- **Joint Staff**
  - **C2 Joint Integrating Concept**
  - **Net-Centric Joint Functional Concept**
  - **Force Application Joint Functional Concept**
- **MTTP**
  - **Joint FIRES**
  - **Time-Sensitive Targeting**
  - **Theater Air-Ground System**
- **USN/USA/USAF Transformation Roadmaps**



Evolving the Shared Knowledge Environment

Current Systems



GCSS

GCCS-J

Platform Centric Characteristics

- Systems oriented
- Man – Machine interface
- Entry point closer to Milestone A-Focus: System Development
- Specific design requirements process (dream and develop)
- Years spent developing entire system
- Tightly integrated functionality
- Test against perfection
- System-level security
- Rigid boundaries
- Prime contractor

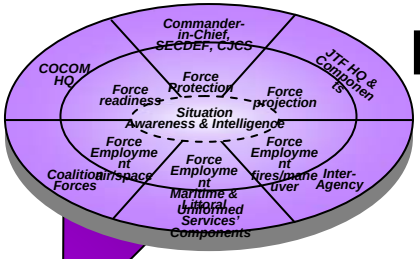
Evolving Environment

ABILITY TO:

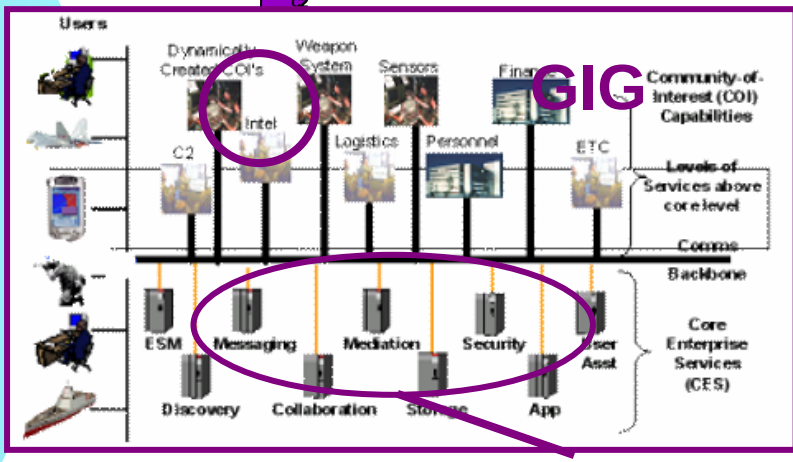
- Establish appropriate organizational relationships
- Collaborate
- Synchronize actions
- Share situational awareness
- Share situational understanding
- Conduct collaborative decision making / planning
- Achieve constructive interdependence

SOURCE: NCE JFC, 7 Apr 05

Future Capabilities



NECC
(JC2)



NCES

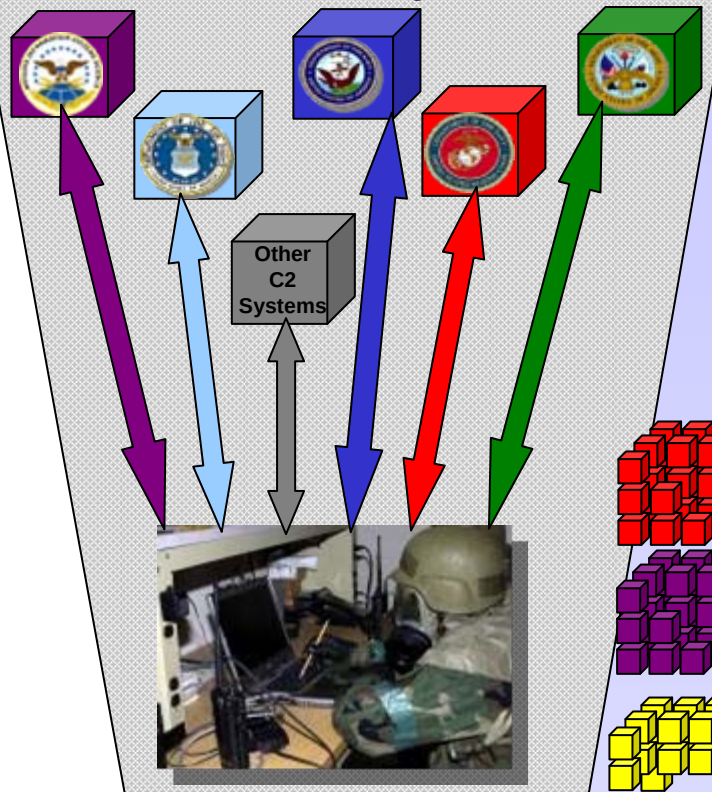
Net Centric Characteristics

- Services oriented
- Machine – Machine interface
- Entry point closer to Milestone C- Focus: Capabilities Piloting
- Functionality-based, close enough (see and use)
- Dynamic functionality through composability
- Loosely coupled functionality
- Balanced operational risk
- Security to be built in
- Living and adaptable environment
- Lead Technical Integrator

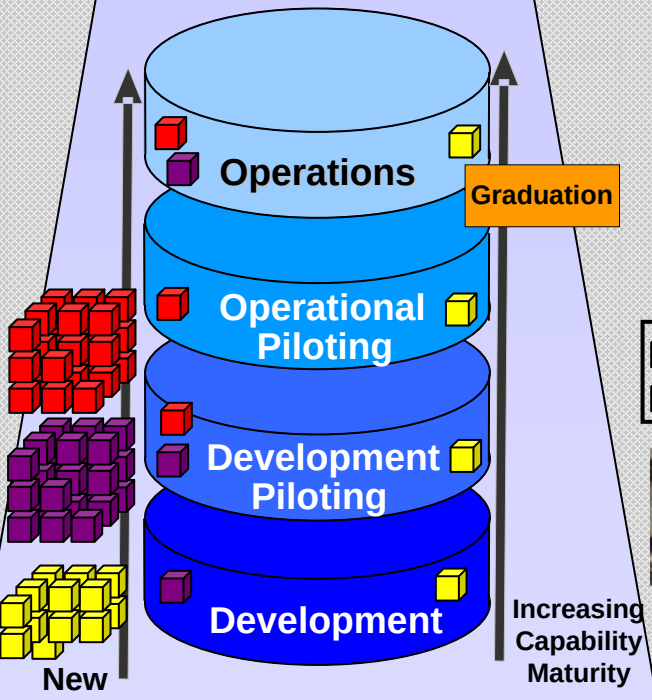
USJFCOM

Net-Enabled Command Capability (NECC)

Current C2 Systems

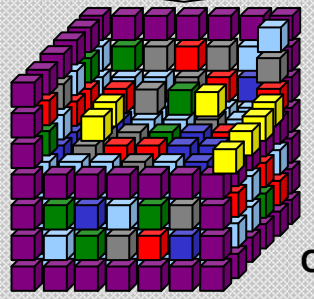


NECC "SANDBOX"

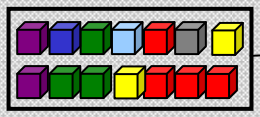


Net-Enabled Command Capability

Systems transformed into discrete capabilities



C2 Capabilities



Mission Thread i.e. Situational Awareness

Now

Systems Focus

Stove-piped systems

Information push

Federated Development & Certification Environment (FDCE) aka "the Sandbox"

CC/S/As bring their "Best of Breeds"

Future

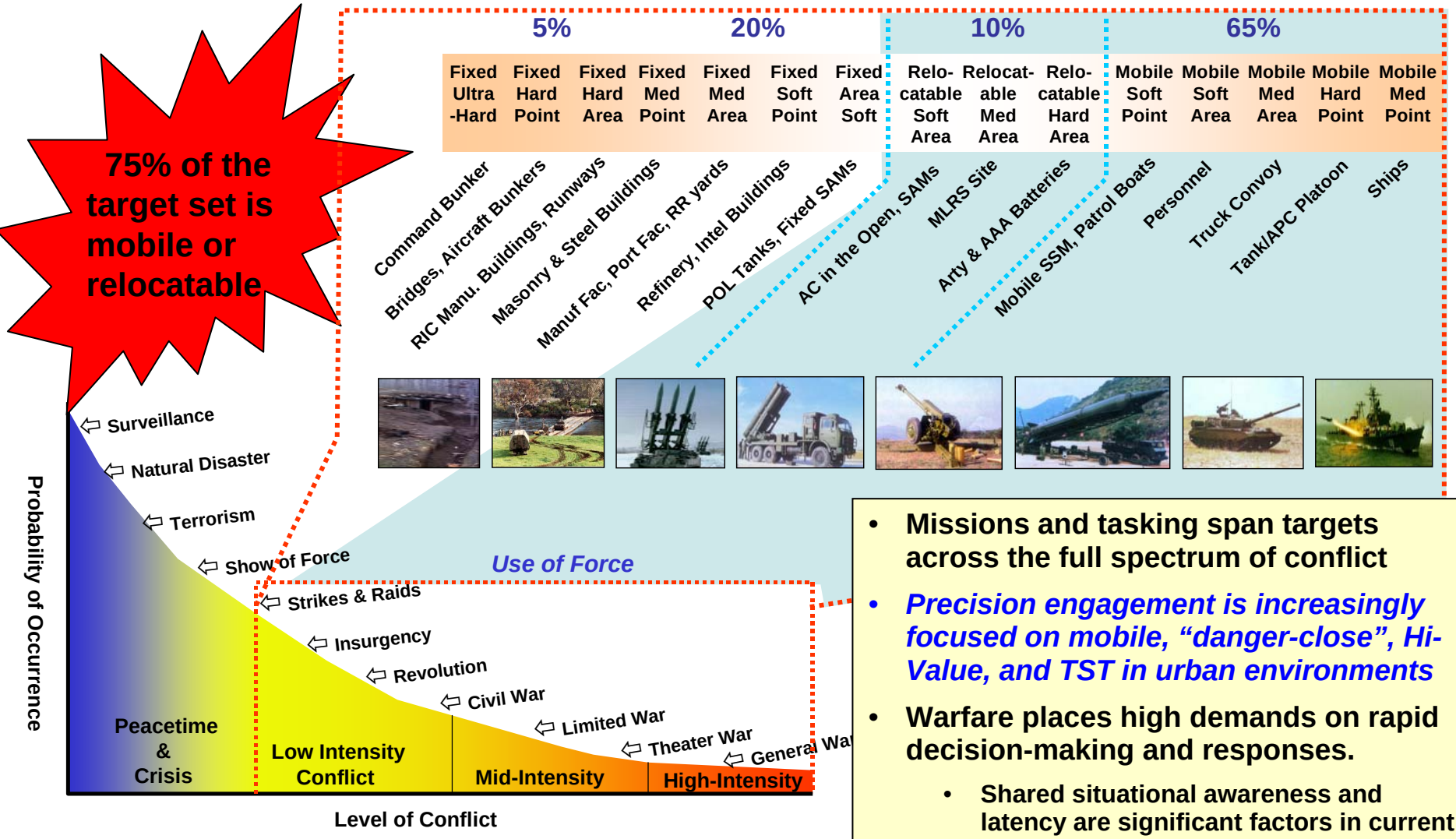
Capabilities Focus

Net & Data - Centric

Information pull

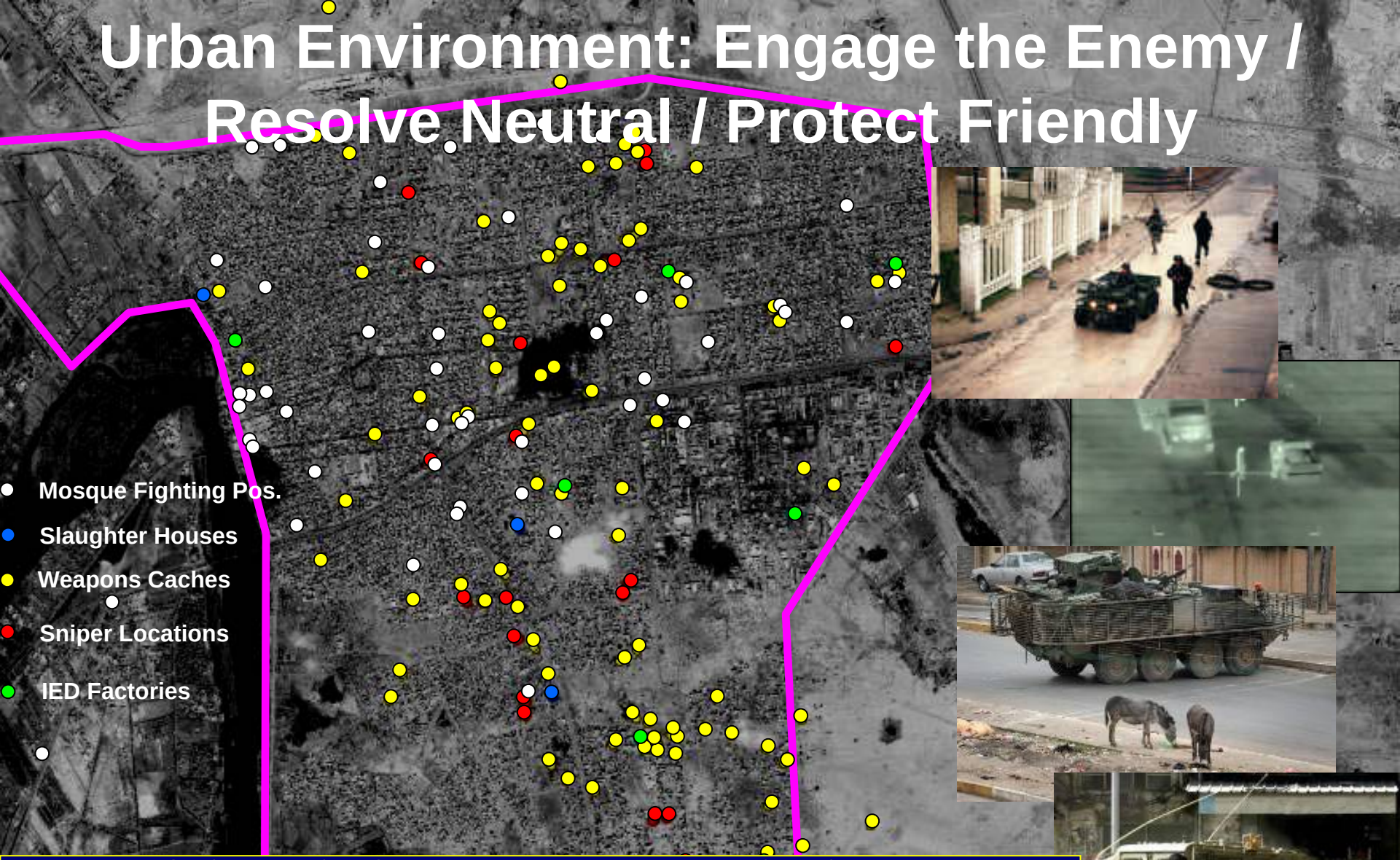
NECC – Transforming C2 for the Warfighter

Joint Fires Integration Challenge



- **Missions and tasking span targets across the full spectrum of conflict**
- ***Precision engagement is increasingly focused on mobile, "danger-close", Hi-Value, and TST in urban environments***
- **Warfare places high demands on rapid decision-making and responses.**
  - **Shared situational awareness and latency are significant factors in current centralized C2 processes.**

Urban Environment: Engage the Enemy / Resolve Neutral / Protect Friendly



Warfighters lack means to accurately characterize and consistently sort enemy, friend, or neutral ground entities in sufficient time to effectively and safely employ weapons and execute military options.

CID-BFT / JBFSA Executive Steering Committee (ESC)

JROC
Operations Deputies
OSD
AMCB

Co-chairs:
USJFCOM
2 Star &
BA FCB Chair

- Implementation championed by USJFCOM Commander
- Utilizes JS 136/KMDS Process
- Services lead Issues/Actions
- Service positions brought to ESC

USA 1-2 Star	USAF 1-2 Star	USN 1-2 Star	USMC 1-2 Star	COCOM/OSD 1-2 Star	Joint Staff 1-2 Star

ESC WG

USJFCOM O6

- Develop, coordinate, execute annual Action Plan

USA 06	USAF 06	USN 06	USMC 06	COCOM/OSD 06	Joint Staff 06

Service/COCOM/OSD positions brought to ESC WG

USA	USAF	USN	USMC	COCOM/OSD

Combat Identification

- **"Combat Identification ... includes cooperative and non-cooperative … an "all-entity" perspective.**
  - **The process of attaining an accurate characterization of detected objects in the joint battlespace**
  - **To the extent that high confidence, timely application of military options and weapons resources can occur.**
- **Select Combat ID Focus Areas**
  - Cooperative (identification (ID) of Friend) technologies for use in Ground-Ground and Air-Ground
  - Non-cooperative (ID of Enemy, Neutral and Friend) machine-to-machine, **net-enabled technologies on C2, ISR** and fixed wing ground attack aircraft

Blue Force Tracking / Joint Blue Force Situational Awareness

- **Blue Force Tracking (BFT): capability provided by a family of systems.**
  - **Techniques to actively/passively identify & track US, Allied, or Coalition Forces Position Location Information.**
  - **Provides enhanced battlespace situational awareness; reduces fratricide.**
  - **Blue Force Trackers: generate, report and / or display blue tracks and related data.**
    - **Force XXI Battle Command Brigade and Below (FBCB2); Movement Tracking System (MTS)**
    - **Grenadier BRAT; Movement Tracker (MTX)**
    - **NATO Friendly Force Tracker (NFFT); Coalition Force Tracker (CFT); Afghanistan Force Tracking System (AFTS)**
- **Joint Blue Force Situational Awareness (JBFSA): BFT enhanced by two-way decision quality data sharing.**
  - **Tracking devices and transmission media employed to obtain, report, and share Blue force identification, location, *status and intent* information.**

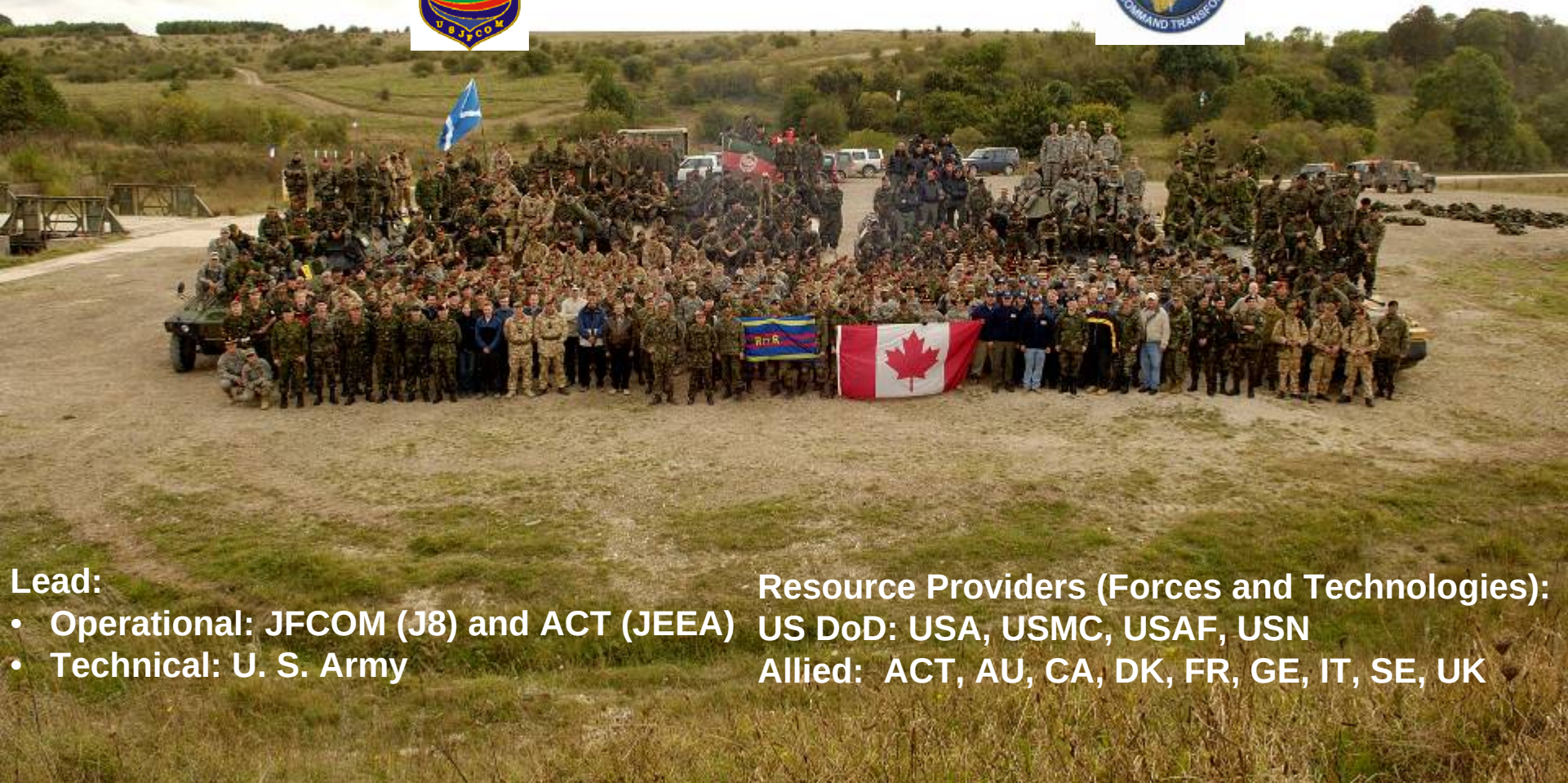
CID-BFT/JBFSA ESC POM 08-13 Investment Recommendations to JROC

- **Mode V IFF Synchronization**
- **Battlefield Target Identification (BTID)**
- **Radio Based Combat Identification (RBCI)**
- **2nd Generation FLIR**
- **Advanced Targeting Pod**
- **Visual ID Training capability**
- **Joint Sensor Signatures Database**
- **Mission Management Center**
- **Joint Tactical COP Workstation**
- **Patriot PID capability**

CCID ACTD "Urgent Quest"

"If we're ever going to operate together, you have to figure out how to build your systems so that they're interoperable, preferably from the outset … I can't tell you how much money we've spent in Iraq and Afghanistan trying to make systems talk to one another that should have been able to talk to one another in the very beginning"

General Lance Smith USAF
CDRJFCOM and SACT
15 Feb 2006



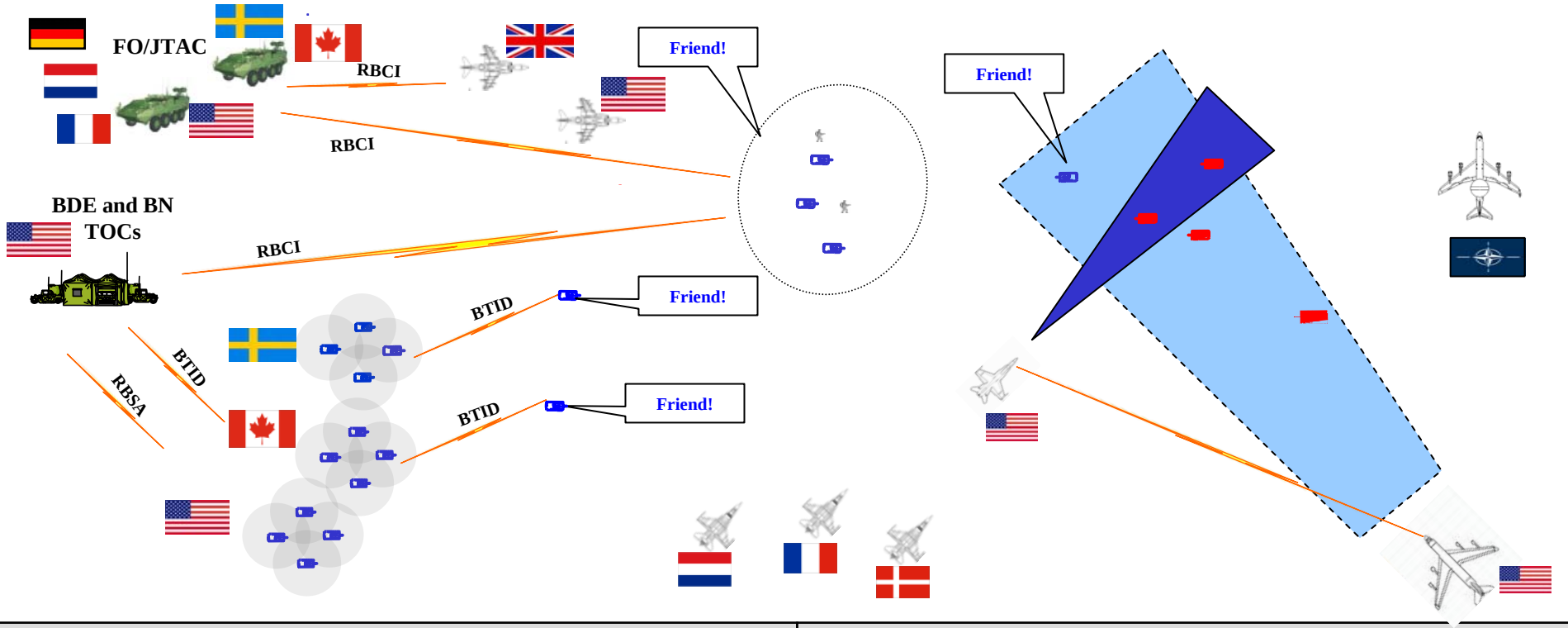
Lead:
- **Operational: JFCOM (J8) and ACT (JEEA)**
- **Technical: U. S. Army**

Resource Providers (Forces and Technologies):
US DoD: USA, USMC, USAF, USN
Allied: ACT, AU, CA, DK, FR, GE, IT, SE, UK

BOLD QUEST Coalition Combat Identification (CCID) ACTD

GOALS

- **Assess the military utility of Non-cooperative Target Identification (NCTI) technologies for Air-Ground Combat ID in coalition operations. Feed USAF POM10-15 Build.**
- **Inform coalition investment in the mix (family of systems) of Target Identification and Blue Force Situational Awareness.**



Joint/Coalition Capabilities

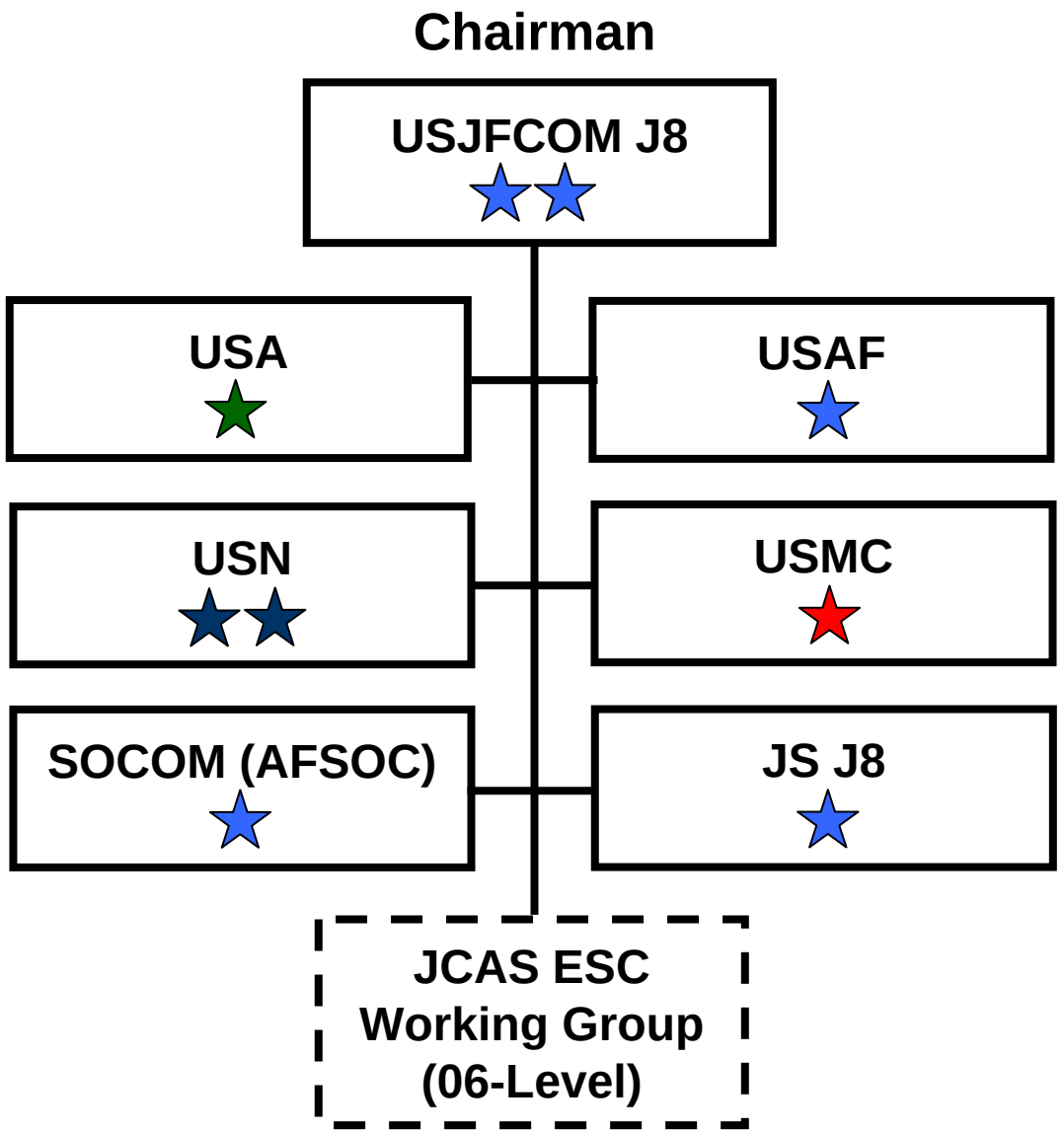
- Non-cooperative target identification from airborne C2ISR and strike platforms
- Cooperative target identification (query/response) from ground combat vehicles and fixed/rotary wing aircraft
- Blue force tracking and situational awareness

ACTD Systems/Hardware (Target ID)

Non-cooperative: Laser Target Imaging (LTI); Synthetic Aperture Radar/Aided Target Recognition (SAR/ATR)

Cooperative: Query-Response (RBCI, BTID)

JCAS ESC



Proposed Additions for JROC Consideration (via 22 Mar 07 JCAS ESC)

Additional Voting Members:

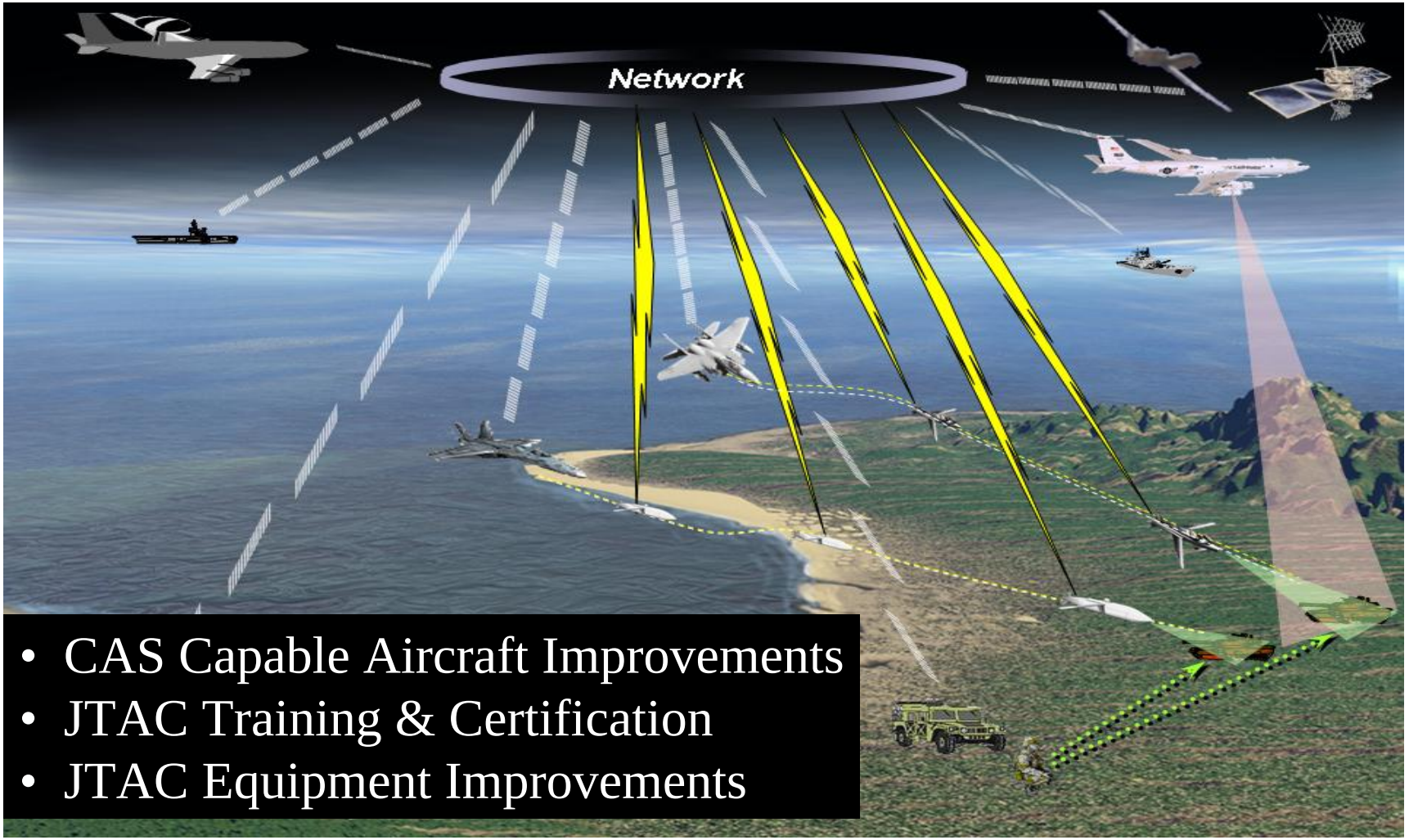
- OSD(NII)
- USD(AT&L)
- COCOMs
- JT FCB
- FA FCB

Additional Non-Voting Members:

Participating Coalition countries (UK, Australia, Canada…)

Digital Information to the Cockpit

Air-to-Ground Tactical Network



CAS Capable Aircraft Improvements

- Add VMF capability to the AV-8B with form/fit replacement of ATHS-II with StrikeLink (A) enabled hardware consisting of a processor, a modem and a 1553 interface
  - Potential low cost solution
  - Interoperability
  - Leverage StrikeLink software
  - Initial fielding of capability without OFP update requirement
- Working with PMA-209 for development of StrikeLink (A) as a common avionics WRA
- Ongoing:
  - ☑ H-1 joining effort to implement for capability demonstration and potential MEU deployment
  - ☑ Feb 07 briefing in Rota , Spain to JPO Harrier partners (Spain, Italy, UK)
  - ☐ V22 discussion in work
  - ☐ MAWTS-1 digital CAS discussion on-going
  - ☐ JFCOM engaged with USAF for possible application

JTAC Standards Improvements

- Training and certification standards
  - JTAC MOA created JTACs and established standards recognized across DoD
  - Coalition JTAC training / standardization next
    - **Australian JTAC Course accredited Mar 06**
    - **UK, Canada, Denmark and Netherlands in coordination**

JTAC Equipment Improvements

- Equipment interoperability
  - Service/SOCOM Tactical Air Control Party (TACP) equipment suite program managers and technicians exchanging ideas for improving digital interoperability near-term
  - Joint Effects Targeting System (JETS) is common solution for long-term
    - Light-weight, handheld Target Location Designation System (TLDS)
    - Light-weight, handheld Targeting Effects Coordination System (TECS) = computer + software

Reliable Target Characterization = Enhanced Engagement

"It is not the object of war to annihilate those who have given provocation for it, but to cause them to mend their ways."

-Polybius, Greek Historian (2nd Century B.C.)

Questions?

Contact Info:
Mr. Doug "Butch" Cassidy
Deputy Chief, Joint Fires Division J85
US Joint Forces Command
Commercial 757-836-8182
E-mail: douglas.cassidy@jfcom.mil

Fires

An Operational Perspective

COL Bob Cunningham

24 April 2007

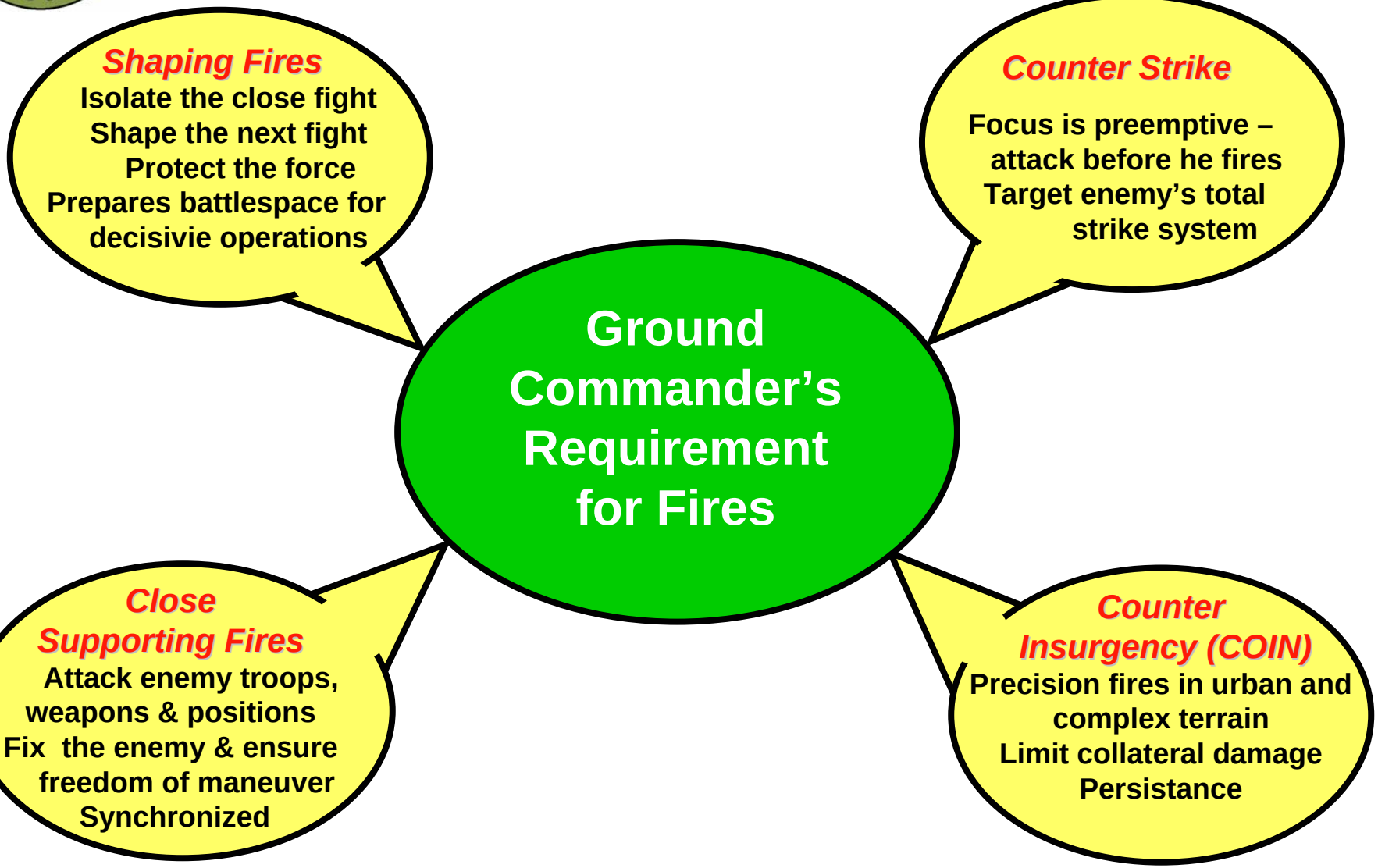
"Our Army at War -- Relevant and Ready"

CHALLENGE

- Synchronization Of Effects
  - Time and Space
- Ground Maneuver Is Event Driven
  - Multiple Echelons
- Flexibility Is Key
  - Multiple Decisions
- Persistance
- Minimize Collateral Damage

Responsiveness Is Essential

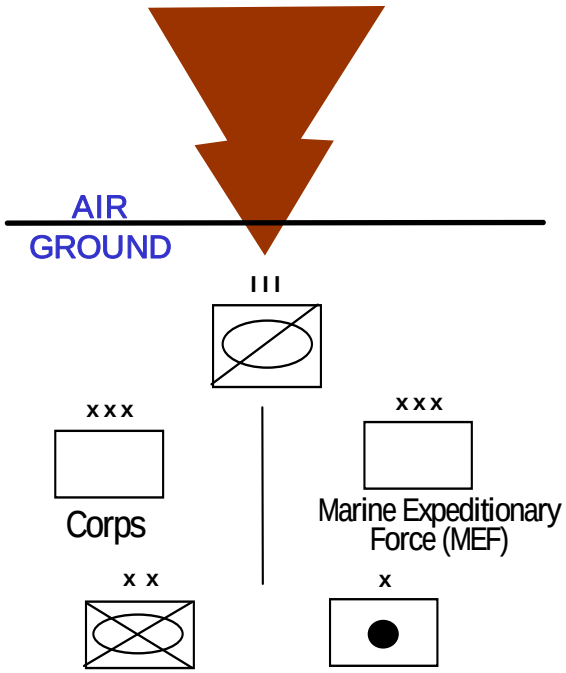
Ground Commander's Requirement for Fires



Emerging Battlespace Perspective

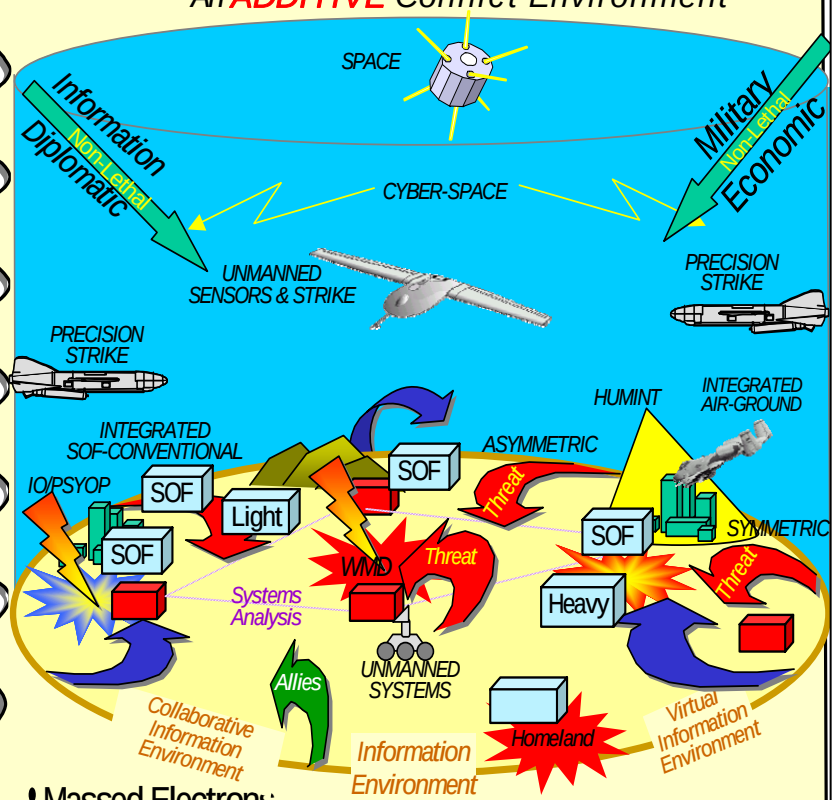
From Battlefield to Battlespace

Conventional



- Massed Forces
- More Deconflicted than Integrated
- Attrition Warfare
- Military to Military
- Symmetrical

An ADDITIVE Conflict Environment



- Massed Electrons
- Smaller Formations
- Lethal & Non-Lethal Fires, Forces . .
- All Elements of National Power
- Rapid & Asymmetric Action
- Simultaneous Operations
- Smaller Operations
- Effects Based Operations
- Flexible, Dynamic Command & Control Relationships
- Operational and Strategic Seams . . .

FOR OFFICIAL USE ONLY

Army Indirect Fires – The Way Ahead

Transforming Fires

From → **To**

- Linked
- Access to Joint systems
- Connected to sensor outputs
- Less Agile / Heavy
- Support to Maneuver
- Lethal (through mass)
- Area effects with limited precision
- Large logistics burden
- Ability to mass fires
- 24/7, all weather

- Networked battle command
- Interdependent with Joint systems
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- Strategic and tactical mobility
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- Ability to mass effects; lethal and non-lethal
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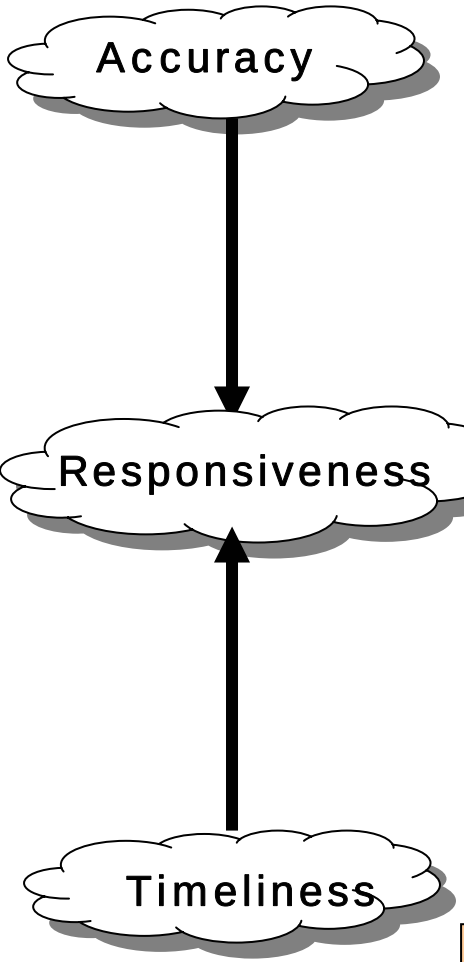
to achieve **Destructive, Suppressive, Protective and Special Purpose Effects**

ACCURATE and TIMELY EFFECTS



Target Location Error (TLE)

+

Robust Network

+

Circle Error Probable (CEP)

+

Processing Procedures

+

Clearance

Responsiveness Is Essential

Joint Fires Application Issues

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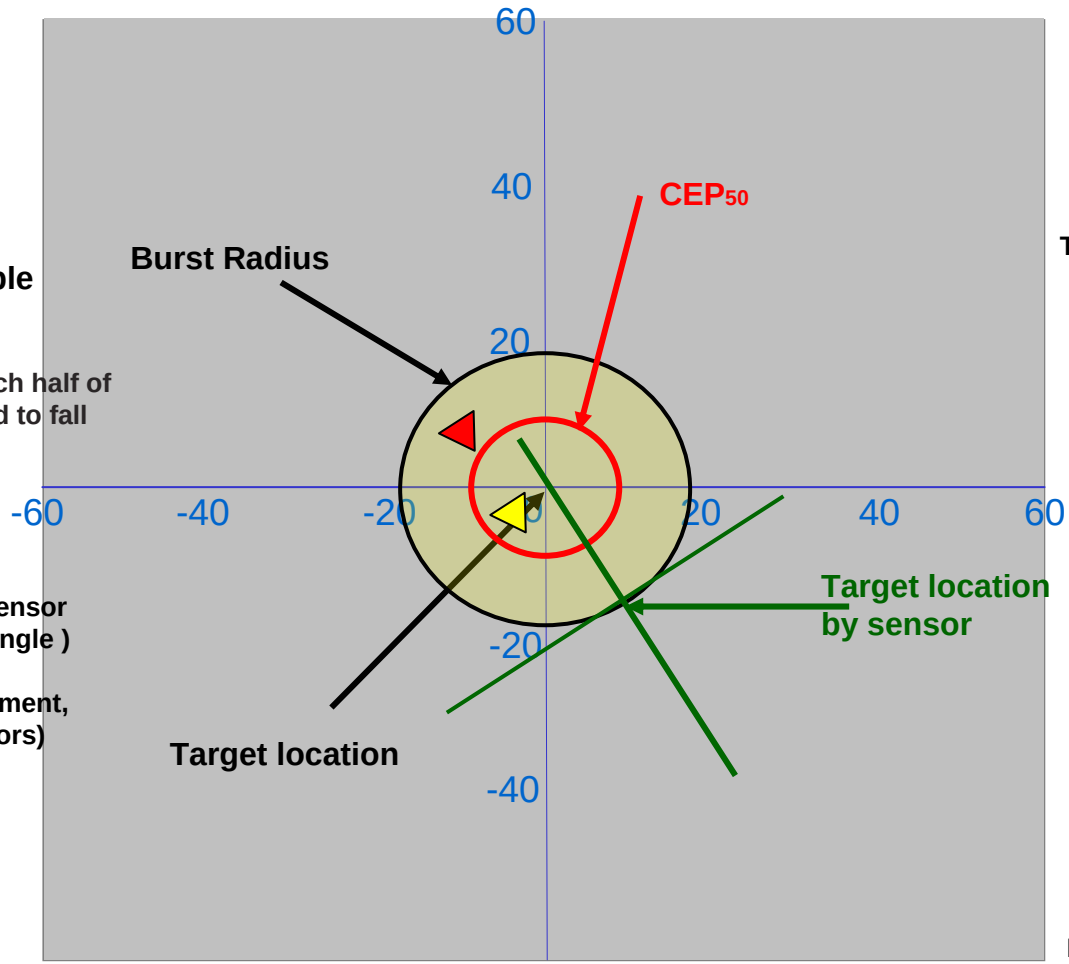

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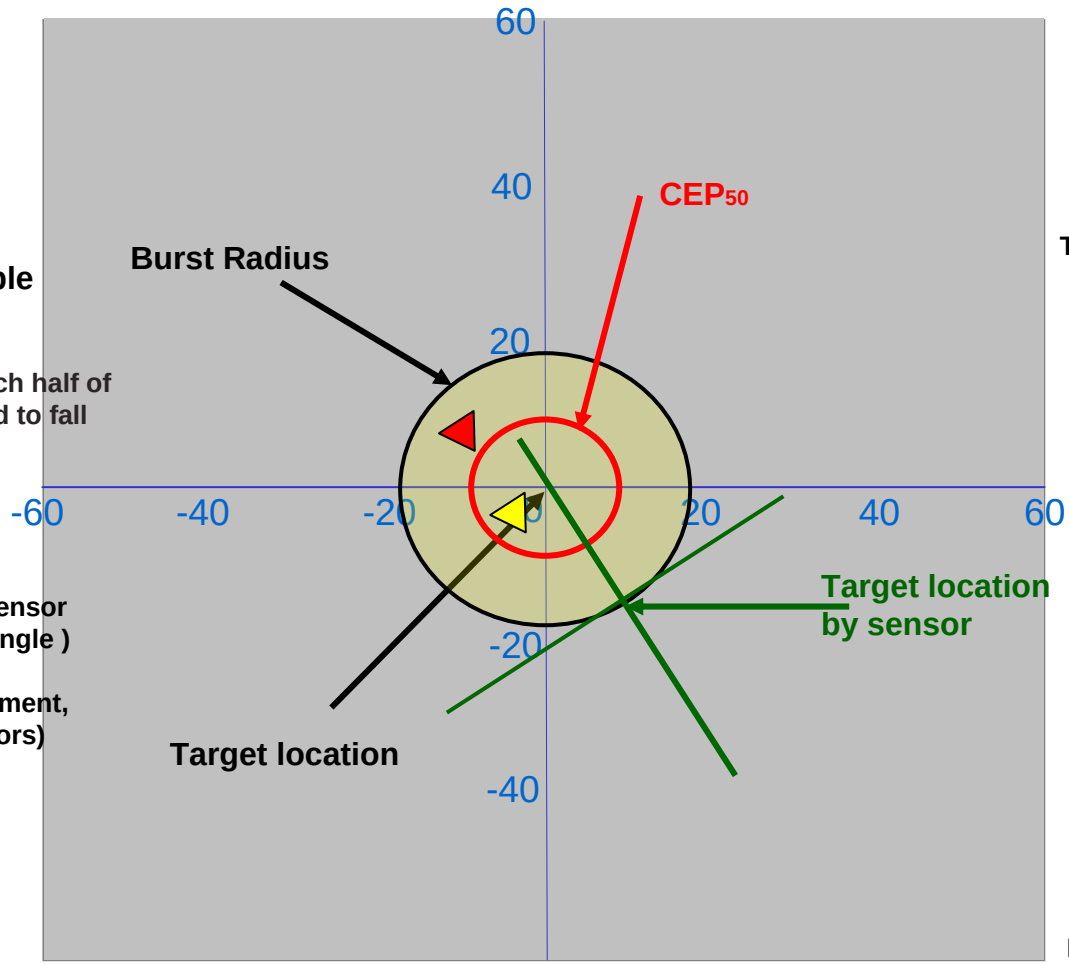

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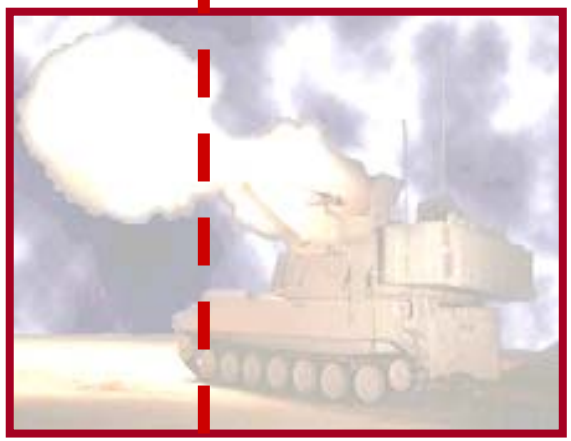

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Munitions Terminology

Precision Munitions

Capable of self locating and maneuvering to a specific location with an accuracy sufficient to yield a high probability of destruction within its inherent capabilities.

Smart Munitions

Self-contained capability to search, detect, acquire, and engage individual targets by detecting the general target characteristics in order to provide terminal guidance for the munition or submunitions.

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Force Development

Fires

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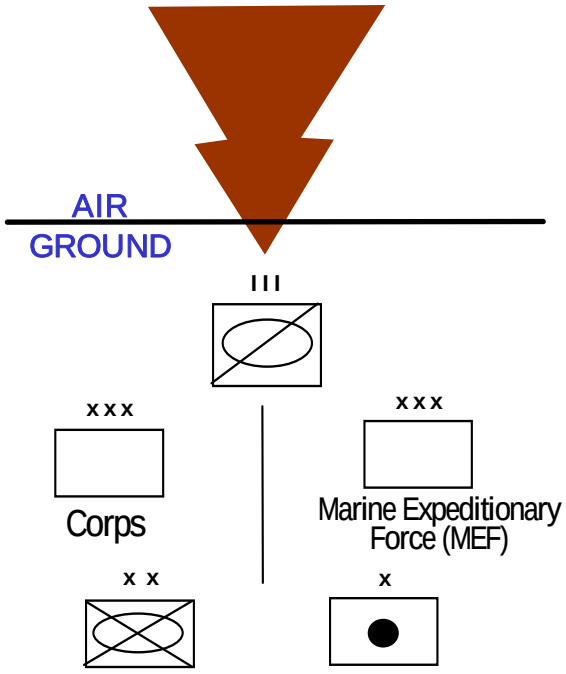

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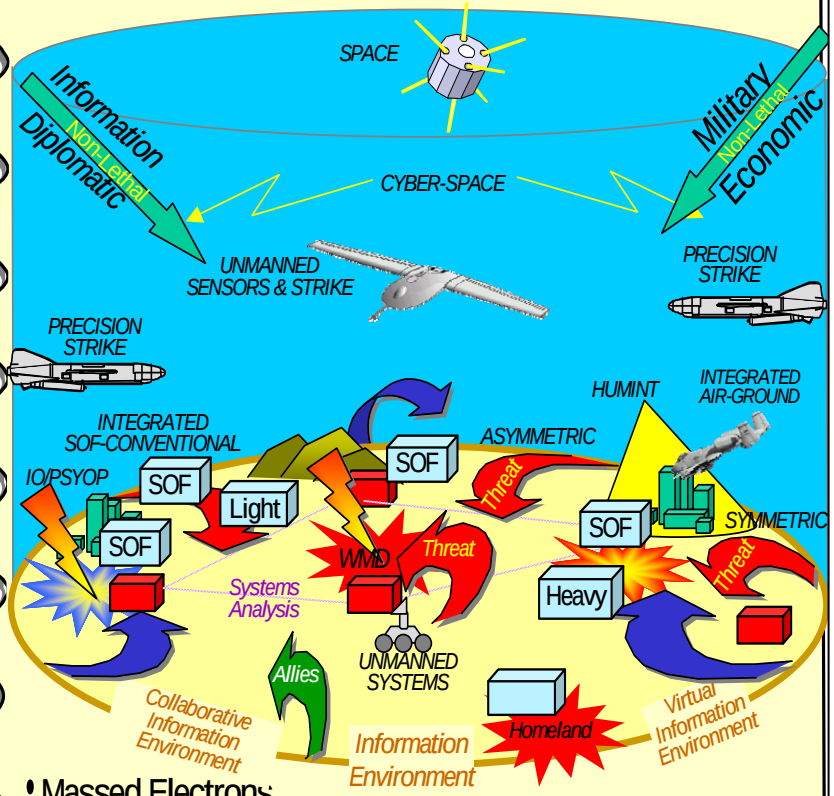

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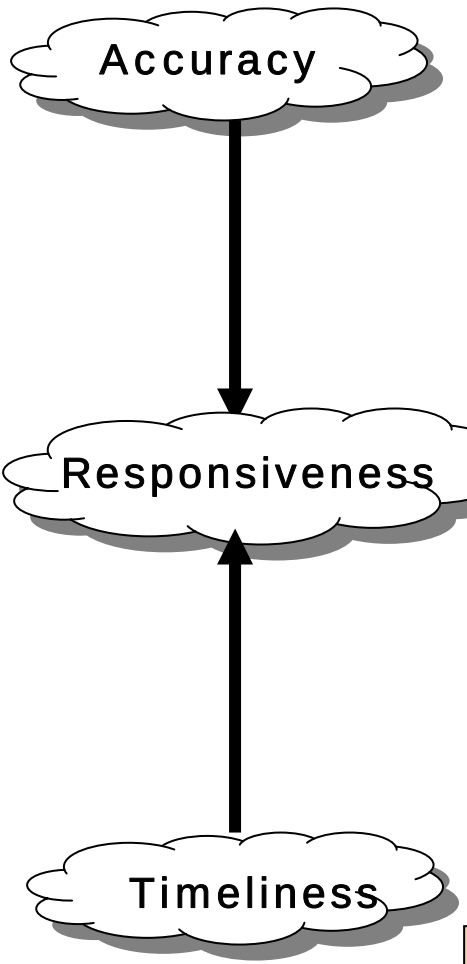

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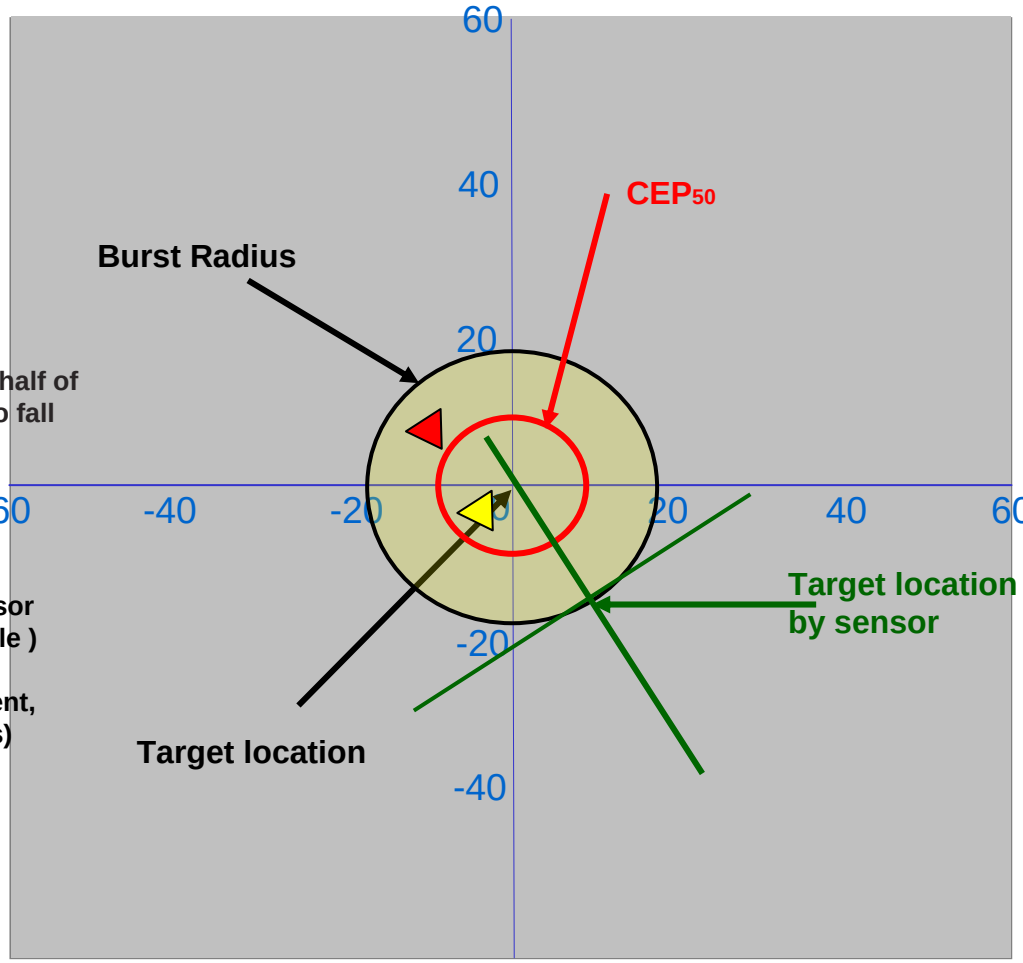

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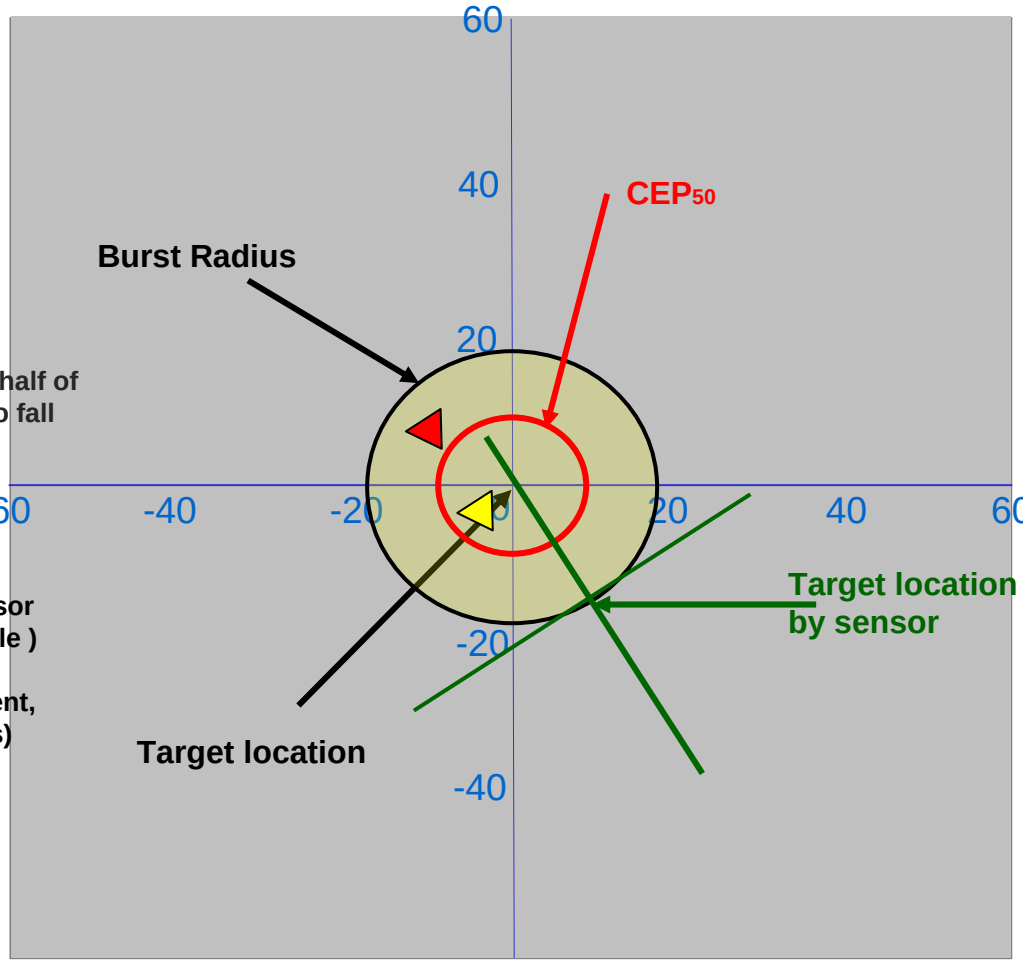

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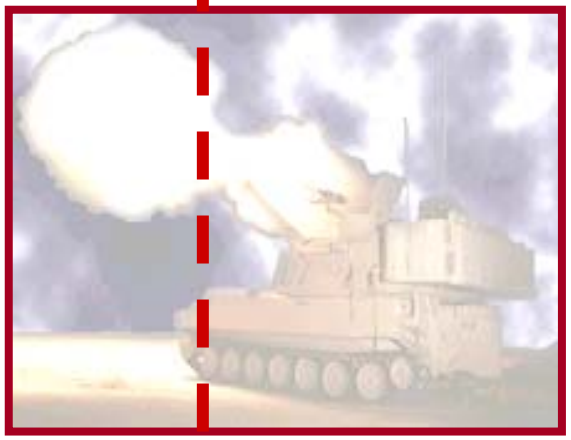

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Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force Global Strike CONOPS Support to STRATEGIC Global Strike

Lt Col Ed Donaldson
HQ USAF Global Strike
Deputy Division Chief

U.S. AIR FORCE

U.S. AIR FORCE

Overview

- Introduction
- Points of Reference
- Global Strike CONOPS Support
- Operational Capabilities
- Enabling Capabilities
- Global Strike CONOPS Effects
- Challenges

U.S. AIR FORCE

Points of Reference

- **Concept**
  - **AF Global Strike – Create operational and strategic effects enabling joint forces to meet time and access challenges across a unified battlespace**
- **Capability**
  - **Long Range Strike – Respond within hours to days with persistence against broad range of targets**
  - **Prompt Global Strike – Respond within hours to minutes, in low volume, against high value targets**

Global Strike CONOPS Support

U.S. AIR FORCE

- Critical role in Capabilities Based Planning
  - Identify and describe effects
  - Articulate capabilities needed to produce effects
  - Commanders use the capabilities to accomplish tasks in support of objectives
- Accomplish an Air Force Capabilities Review and Risk Assessment

U.S. AIR FORCE

Operational Capabilities

- Suppression of Enemy Air Defenses
- Air-to-Air Superiority
- Space Superiority
- Long Range Strike
- Intra-Theater Strike
- Electronic Attack
- Network Attack
- Influence Operations
- Special Operations

U.S. AIR FORCE

Enabling Capabilities

- Command and Control
- Surveillance and Reconnaissance
- Intelligence
- Network-Centric Warfare
- Global Mobility
- Force Protection
- Personnel Recovery
- Agile Combat Support

U.S. AIR FORCE

Global Strike Effects

- **Rapid Strike – Quickly neutralize and adversary's high value targets through and in air, space and cyber domains, at the time of our choosing to achieve national objectives**

- **Gain Access – Project forces in anti-access environments and create conditions to gain and maintain battlespace access for persistent joint forces to operate with acceptable risk**

U.S. AIR FORCE

Global Strike Capability Challenges

- Integrated Solutions across the kill chain
- Survivability in and through anti-access environments
  - Platforms and Weapons
- Increased range and persistence
- Responsive Payloads
- Real Time Assessment

F/A-18 & EA-18G Program

Capable, Affordable & Joint Interoperable...Today & Tomorrow

CAPT "BD" Gaddis
F/A-18 Hornet & EA-18G Program Manager
24 April, 2007

Key Messages

F/A-18E/F Super Hornet: It's the most capable, affordable, and effective multi-mission fighter-attack aircraft in the world. It will fly and fight from carrier flight decks thru 2030.

The F/A-18E/F and EA-18G, and its advanced sensors, pinpoint targeting, computing and connectivity capability, and precision weapons, has already started to transform the way Navy fights (e.g. AAW, ASUW, NTISR and TST).

Next generation capability -- cooperative, multi-moving, and multi-spectral targeting, Combat ID, IP-based networking, and networked enabled weapons -- is on the F/A-18E/F Super Hornet & the EA-18G Growler "Flight Plan."

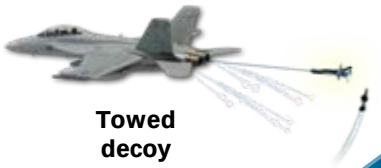
Navy Carrier Strike Groups & F/A-18 Hornets

- Carrier flight decks are now filled with Hornets, Super Hornets and USMC F/A-18A+ only
- Production continues 3 months ahead of schedule
- "Flight Plan" in place to ensure Super Hornet paces the threat past 2024
- Super Hornets will fly and flight from carrier flight decks until 2030
- Long term support in place
- Long term complement to F-35 LITENING II Strike Fighter

The F/A-18E/F is the key element of the USN's long-term force structure

The Multi-Mission Super Hornet
Flexible Air Power

Survivability: IDECM Block 2 & ALR-67 (V)3 ALQ-214 and ALE-50/55



Towed decoy

Advanced Crew Station (ACS)
- Advanced Situational Awareness
- 8x10 Large Display

Advanced Computing Architecture

F414-GE-400
Time-on-wing >600 hr

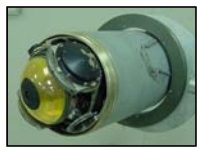
Advanced mission computer
- Open architecture, portable, scalable
- HOL/C++ OFP
- Commercial SEE
- Fiber channel switch/OI

Digital solid state recorder
- COTS
- Annotated Image Transfer
- JMPS compatible

Air Defense Suppression
All-Weather Precision Attack
Air Dominance
Electronic Attack
OCA/DCA
CMD
NTISR
TACRECCE
Fighter Escort
Maritime Strike
Close Air Support

ATFLIR

Active Electronically Scanned Array (AESA) Radar



IR Search & Track Pod

Air-to-Ground

JDAM 500
JSOW
GBU-24B/B
GBU-16
GBU-32
BRU-55
HARM
HARPOON
SLAM_ER

JHMCS
(front and aft seat)

AIM-9 Sidewinder
AIM-120A/B/C AMRAAM

Air-to-Air

Road RECCE mission

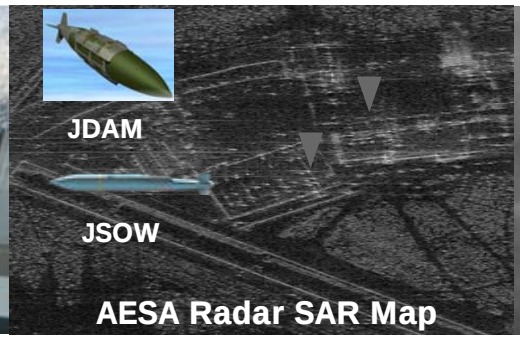
Digital network connectivity (MIDS L16 and DCS radio with VMF)

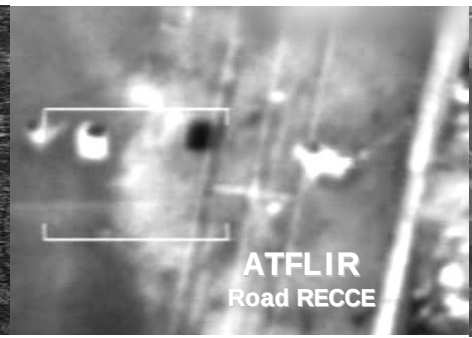
Reconnaissance

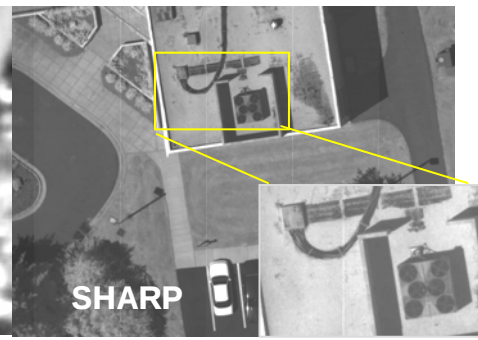
Tanker

Unprecedented multi-mission flexibility...
First day of the war capable and everyday thereafter

Super Hornet Links the Power of the Network to the Warfighter

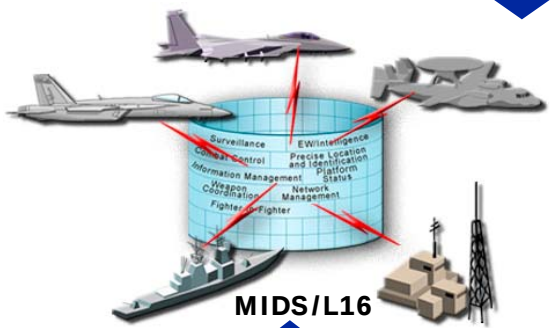






AIRCRAFT SENSOR INTEGRATION

DCS/VMF
nine-line brief



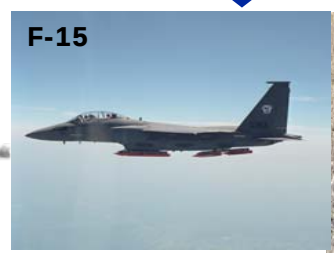
MIDS/L16

SHARP DATA LINK

CONNECTIVITY PATHS

E-2D

Ground Station
(CAOC)



NAVAIR

F/A-18E/F "Flight Plan"
Next Generation Capability Paces the Threat

POM08/PR09	POM10	POM12	POM14

Distributed Targeting

Onboard Geo-Registration Multiple Movers Combat ID
IRST Distributed Targeting Processor

Sensor Integration

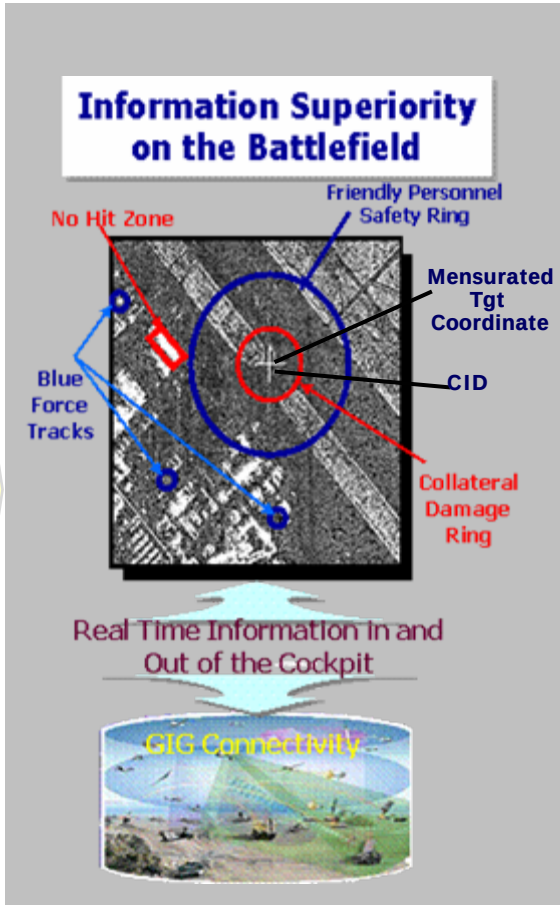
Electronic Surveillance Electronic Attack Combat ID Fusion
Cooperative Targeting Emitter Geo-Location

Airborne Networking

Mode "5" IFF MIDS-JTRS w/TTNT Network Applications & Services SATCOM UAV Connectivity

New A/A and A/G Weapons Integration

Networked Enabled Weapons AMRAAM HOBS Dual Mode Weapons



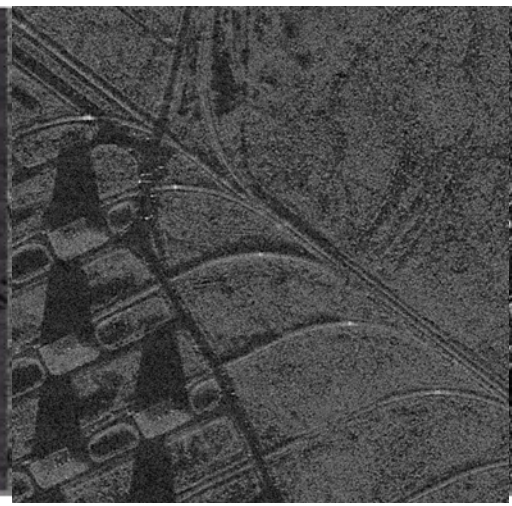
Developed with Open Architecture Principles

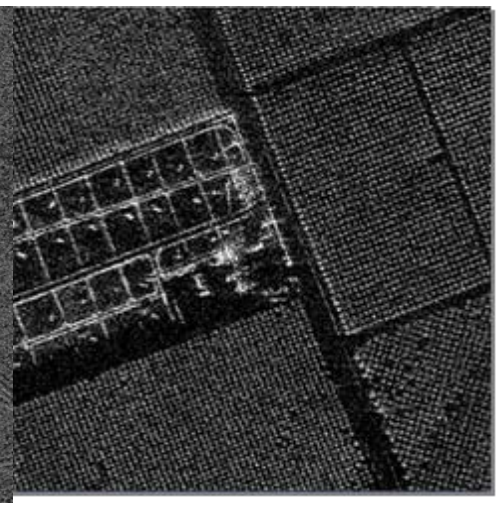
- Modular Design
- Reusable Application Software
- Life Cycle Affordability

AESA Radars in Production
Beginning Full Rate Production in 2007

Facts and Figures

- First Fleet deliveries began in Jan ’06
- First fleet introductions complete!
- First AESA equipped squadron already flying today – VFA-213
- (31) AESA equipped aircraft currently in the Fleet
- (84) APG-79 radars already on order
- Over 5000 Flt Hrs in Fleet & Test
- VFA-213 deploys in 2008





The high resolution APG-79 is changing the game for the warfighter

AESA / JDAM / Link 16

Precision Strike Capability Over the Network

F/A-18E/F AESA SAR map and aircrew designated targets

Link 16

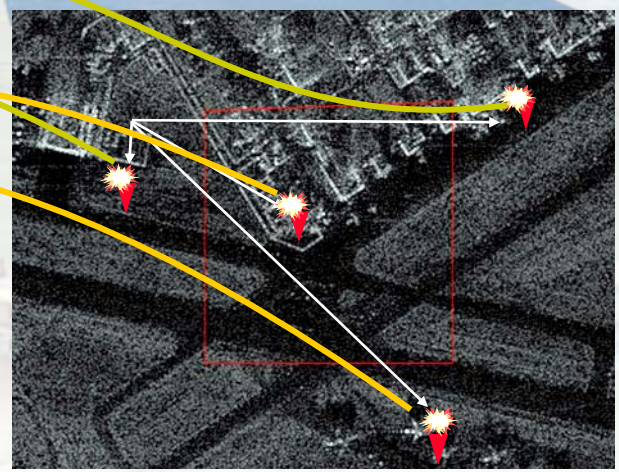
Link 16

Target designation received by AESA aircraft via Link16

- AESA precision self-targeting thru the weather in a networked environment
- Integrated weapon system performance
- AESA is a force multiplier
- Thru link 16 network and future networks all joint forces have AESA capability

Major component of NCO strategy roadmap

- Targeting coordinates sent over MIDS from AESA aircraft to non-AESA strike aircraft
- Multiple target attack in single pass
- Machine-to-machine targeting
- High volume precision fires



All four MK-84 JDAM hit their targets well within specification limits

ATFLIR

- Long-range, high resolution sensor for positive target identification and accurate targeting with high power laser
- Geo-Point accuracy for self- targeting with precision weapons delivery
- High Resolution sensor for Non-Traditional Intelligence Surveillance Reconnaissance in support of ground forces
- Integrated with AESA and APG-73 Radar, JHMCS, MIDS, and Solid State Recorder
- Imagery sent to ground forces thru aircraft data link to Rover III with streaming video, annotated imagery transfer over Link 16, or digital radio with 9-line brief

Link 16 Image Transfer - Fielded -

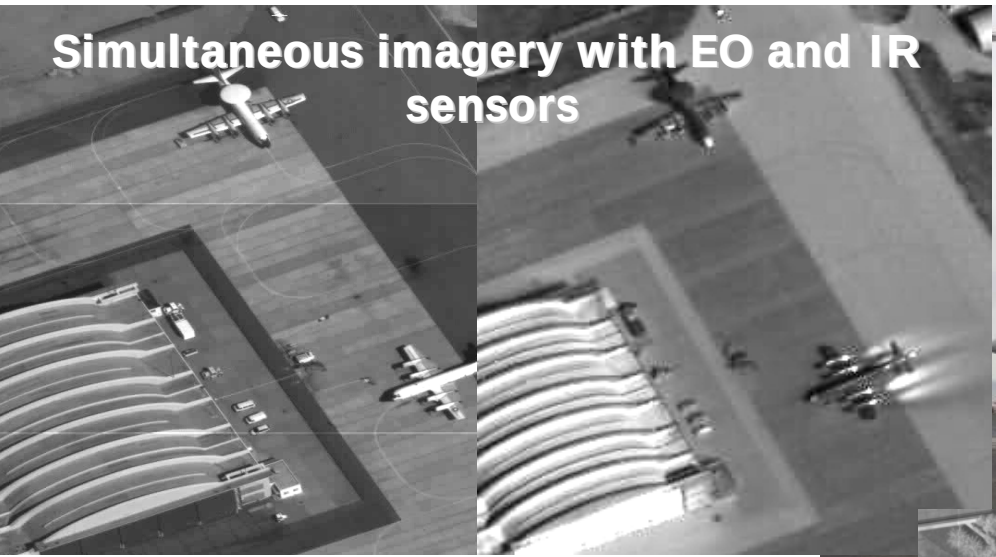
VMF Image Transfer - Fielded

NTISR - Road RECCE

Rover III Streaming Video To JTAC

NAVAIR

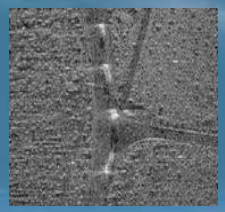
SHARP Recon Pod with Common High Bandwidth Data Link – Deployed in OIF II



Simultaneous data link down to multiple ground stations (e.g. Navy CVN, Army TES-F, Marine Corps TEG)

F/A-18E/F Sensor Integration

AESA SAR



ALR-67(v)3

SEID

Geo-Locate

- ALR-67(V)3 antenna coverage enables 360° geolocation

Sensor Integration Roadmap

- Digitally cued ALR-67(V)3 receiver
- AESA and ALR-67(V)3 integration
- Specific Emitter Identification
- Single Ship Geolocation
- Multi-ship Geolocation
- ELINT recording

Targeting Options:

- HARM/AARGM
- Georegistration of mensurated target coordinate
- JDAM
- JSOW Target Template
- HGEA w/ALQ-214 & AESA (POM10)

AESA APG-79 High Gain ESM in FWD Sector at for greater ranges

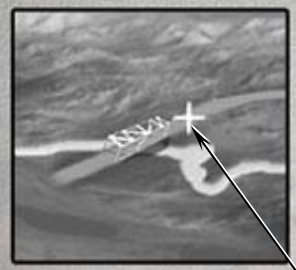
Faster and more accurate target location sufficient for:

- Data made available to EOB Enterprise
- Reduces ambiguity and increases precision
- Threat situational awareness
- Targeting for SEAD (HARM, AARGM)

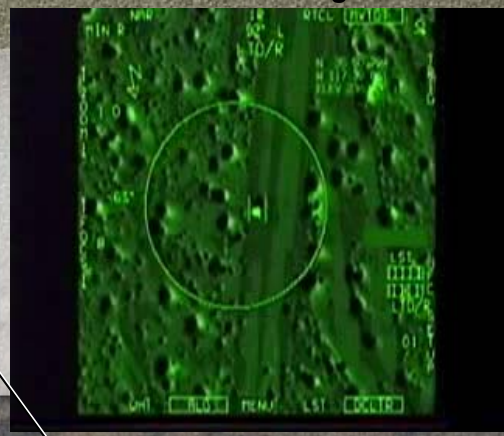
Air Interdiction
Image Precision Targeting

Sensor image correlated to reference image

Reference image used by seeker for guidance



Seeker image



Reference image loaded into JDAM before launch

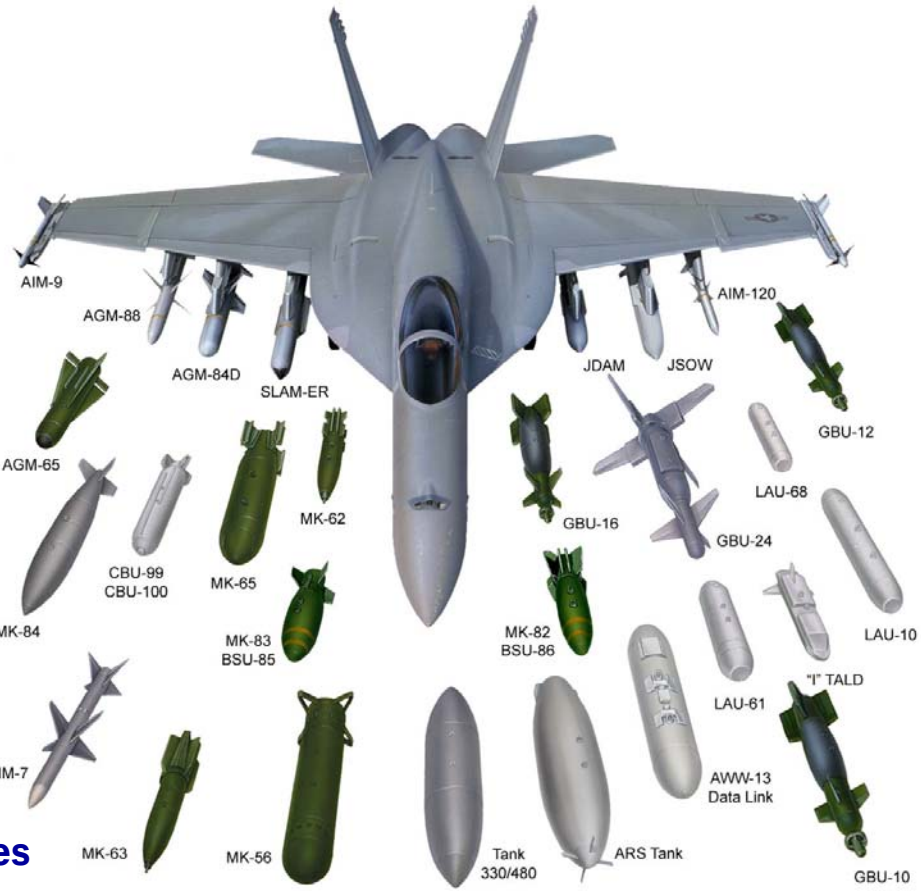
1. Pilot receives target assignment and image
2. Pilot finds target with onboard sensor
3. Sensor image correlated with reference
4. Reference image and target location loaded Into weapon
5. Moving target updates sent to weapon as pixel locations in reference image
6. Weapon matches it's seeker image to reference image
7. Weapon guides to pixel location in image until moving target detected and tracked.

Current target pixel location in reference image

- Pin point targeting
- Multiple target capability
- Weapons darta link capable
- Imagery to weapons

Multiple Moving and Stationary Target Capability at Long Range

Large Payload Capability and Multi-Mission Flexibility



Precision weapon delivery
Survivability
Advanced countermeasures

High Volume Precision Fires

Largest Payload, Significant Mission Flexibility

AIM-9X | SLAMER | JDAM

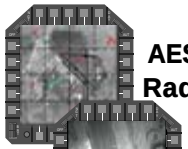
NAVAIR

Multi-Source Integration
- Sensor Fusion & Combat ID -

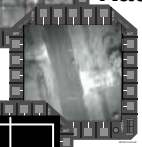
Multi-source integration enhances situational awareness for increased lethality and survivability

F/A-18E/F Block 2

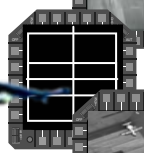
On-board



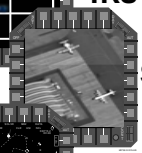
AESA Radar



ATFLIR



IRST



SHARP

EW Suite

Off-board

MIDS/L16

BACN

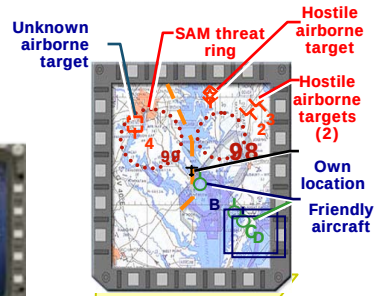
IP based Network

AARGM

A/A, A/G and Maritime MSI

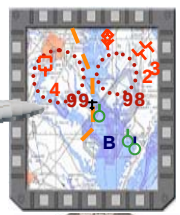
Front Seat Cockpit

Knowledge-Based SA & Targeting



Aft Seat Cockpit

EA-18G



ALQ-218 & SATCOM Receiver Aft Seat

CCS

MIDS/L16

BACN

IP based Network

AARGM

Warfighting Capability:

- Pinpoint target location error for land and maritime targets
- Combat ID from multiple onboard and offboard sources
- Employment of longer range, precision weapons
- Engagement of Stationary and Moving Targets
- Common Operational Air Picture

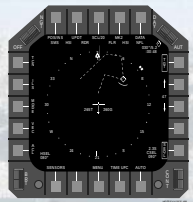
Multi-Spectral Air Dominance

E2-D

SURVEIL/ DETECT

AESA

TRACK / ID

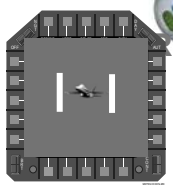


EW Suite
- ALR-67(V)3 RWR
- ALQ-214 Jammer

Cooperative Targeting – Enhanced Lethality & Survivability vs. Advanced Threat

MIDS LINK-16 / Advanced Network

Front and Aft Seat
- Enables High Off Boresight WPNS
- WVR Targeting



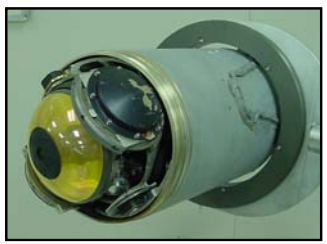
ATFLIR

ALLOCATE

AIM-120 AMRAAM
- Extended Range
- Enhanced Data Link

ENGAGE

AIM-9X BLOCK II
- Data link & P3I Fuze
- BVR Extended Range



IR Search & Track Pod
- Autonomous Search & Track
- Rapid / Large Scan Volume
- Long Range Detection

ASSESS

Super Hornet Block II providing Air Dominance against Advanced Air threats in 2024.

NAVAIR

Vision

UAV's are destined to become the next evolution of the worlds air combat forces.

The integration between manned and unmanned systems will be the first step in meeting those future systems, today.

Questions?

PRIORITY:

" Build a Fleet for the Future

… balanced, rotational, forward deployed, and surge capable – the proper size and mix of capabilities to empower our enduring and emerging partners, deter our adversaries, and defeat our enemies"

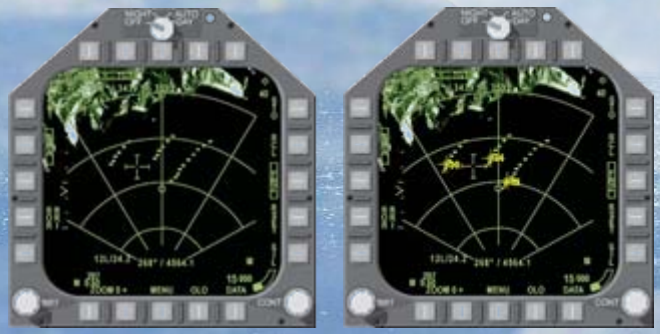
- CNO (CNO Guidance 2007)

Anti-Surface Warfare

AESA Sea Surface Search (SSS)

Optimized for the Maritime Mission

"Flight Plan" includes capability for Maritime MSI and ID



Search Track

- Cooperative Targeting
- Long Range Detection and Track
- Precision targeting of small vessels in sea clutter

- Network Enabled Weapons
  - HARPOON Block III
  - SLAM-ER
  - JSOW-C

Sea surface search mode detects surface ships at long range in any weather

F/A-18E/F Balanced Approach to Survivability

EFFECTIVENESS

SURVIVABILITY

Hard to See, Hard to Hit, Hard to Kill

Joint Interoperability and Networking

Multiple Platforms

The platform must seamlessly move its sensor and weapon information on/off the aircraft, then into and across a joint, networked Battle Space

Information Superiority achieved in a machine-to-machine environment ensures distributed sensors on the tactical edge of Battle Space deliver combat power from the right platform, at the right time with the right weapon

Information flow thru/into Battlespace

- COTP
- BHI
- Onboard Mensuration Coordinates
- BFSA

- Images
- Streaming Video
- Electronic Order of Battle (EOB)
- Surface Picture

- CID:
  - Fixed Target
  - Moving Targets
- Single and Multi-ship Geo-locate

Acquisition Transformation

Precision Strike
Annual Programs Review

April 25, 2007

K. Eileen Giglio
Assistant Deputy Under Secretary, Strategic Plans and Initiatives

Office of the Secretary of Defense
Acquisition, Technology and Logistics

~

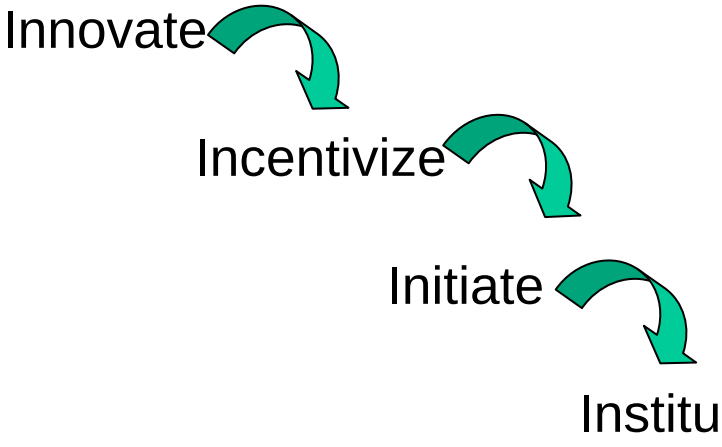
CHALLENGES TO THE ACQUISTION SYSTEM

What's New?

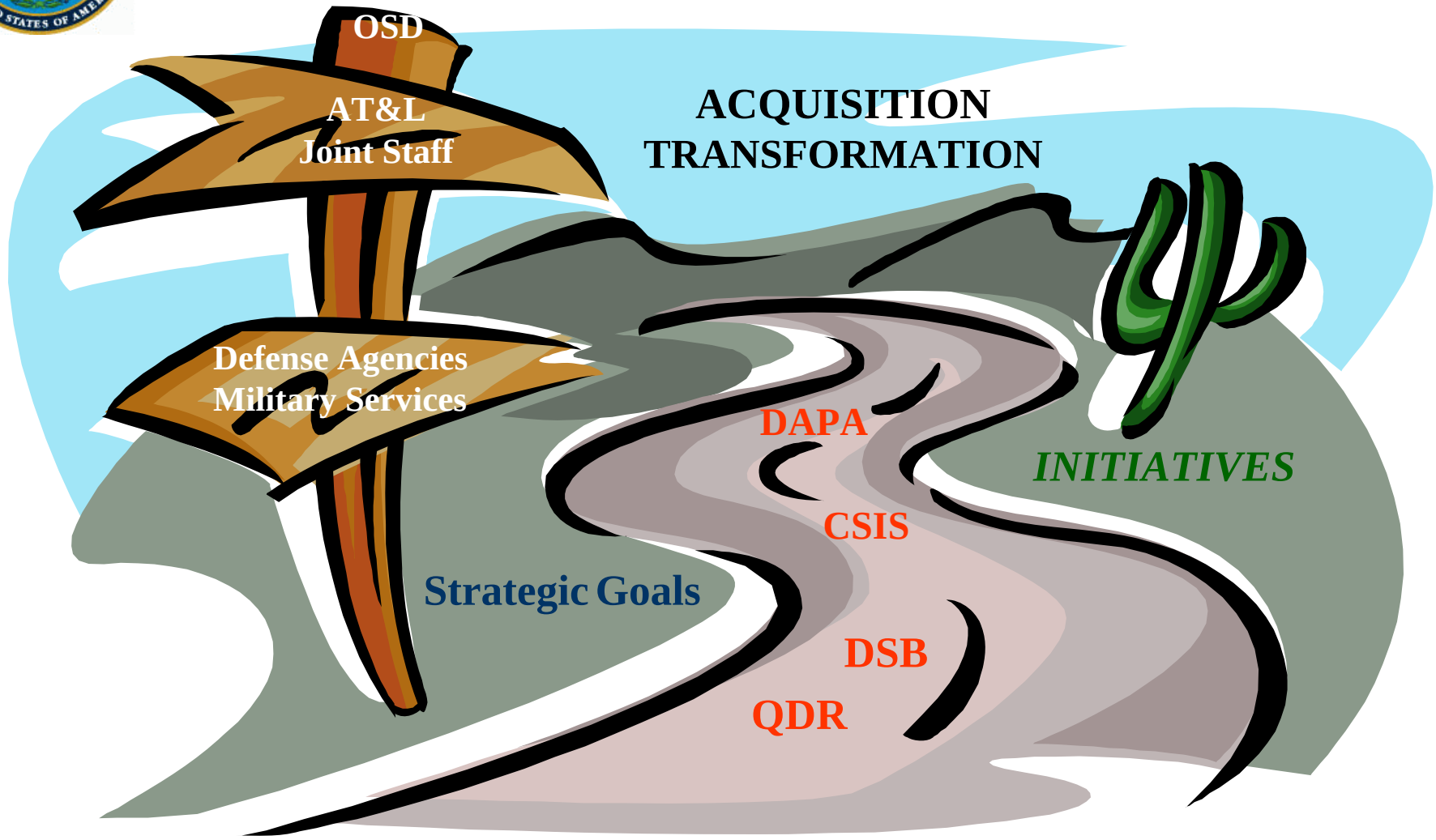
- Post 9/11 - Functional not technical threats
- Immediate Warfighter Needs
- Terrorism
- Asymmetric Threats
- Global markets
- Quadrennial Defense Review and IRG
- Strategic Goals and Initiatives
- Transformation
- Diminishing resources
- Workforce challenges
- Consolidation of Industrial Base
- Contracting based on “Conspiracy of Hope”
- Acquisition slow and complex
- Immature Technologies
- Etc…..

Precision and Adaptability

- Vision
- Communication
- Collaboration
- Cooperation
- Consistency
- Transparency
- Roadmaps
- Partnerships
- Horizontal Integration
- The Four “I”s



Roadmap


OSD
AT&L
Joint Staff
ACQUISITION
TRANSFORMATION
Defense Agencies
Military Services
DAPA
INITIATIVES
CSIS
Strategic Goals
DSB
QDR

Implementing Acquisition Reforms

Section 804 of the National Defense Authorization Act, Fiscal Year 2007 requires biannual reports to Congress regarding the implementation of recommendations as follows:

- **Defense Acquisition Performance Assessment Project, January 2006;**
- **Defense Science Board summer Study on Transformation: "A Progress Assessment, February 2006;**
- **The Center for Strategic and International Studies, "Beyond Goldwater Nichols: U.S. Government and Defense Reform for a New Strategic Era" July 2005;**
- **Quadrennial Defense Review (February 2006).**

The Strategic Plan, to prepare these biannual reports to Congress is designed to 1. Review and experiment with recommendations,

2. identify initiatives that are ongoing across the Department and,
3. track Strategic Plans and Goals.

Acquisition Transformation

The Mission

The Acquisition Transformation process, the Acquisition, Technology and Logistics Strategic Goals Implementation Plan and the Section 804 Report set the stage for real change and accountability. Capturing the data and centralizing the message will ensue from the socialization, focus and visibility on all aspects of acquisition processes – department-wide.

"A sense of urgency has been established to streamline and simplify the Acquisition System with aggressive initiatives to provide lasting solutions for predictable performance. DoD is tracking the milestones to ensure that the desired outcomes in this transformation are achieved."

Section 804 Defense Acquisition Transformation Report to Congress.
February 2006 ~ Ken Krieg

Initiatives ~ Organization

- Acquisition Total Life Cycle Management Culture
- Use the Institutional Reform and Governance Roadmap
- Utilize Tiered Accountability
- Utilize the Enterprise Transition Plan
- Follow the Strategic Communication execution roadmap
- Follow commercial best practices
- Organizational Performance Assessments

Initiatives ~ Workforce

- Implement National Security Personnel System
- Implement Personnel & Readiness Civilian Human Capital Strategic Plan 2006-2010
- Modernize structured learning through the Advanced Distributed Learning Initiative
- Appoint a Director of Human Capital Initiatives to oversee implementation of Strategic Goals Implementation Plan
- Incorporate ethics into every level of acquisition workforce training
- Utilize Defense Acquisition University and the Industrial College of the Armed Forces to provide career development and performance support to the acquisition community

Initiatives ~ Requirements

- Joint Requirements Oversight Council
- Engage the Combatant Command to comment on future capabilities
- Develop a training course specifically focused on the requirements process
- Performance-Driven Outcomes
- Develop weapons system readiness and sustainment modeling capabilities
- Develop mechanisms for rapid acquisition to meet urgent warfighter needs (includes Joint Rapid Acquisition Cell)
- Capability Portfolio Management (renamed PfM to CPfM and combined with Capabilities based decisions)

Initiatives ~ Acquisition

- Tri-Chair Concept Decision Reviews
- Time Defined Acquisition
- Evaluation of Alternatives
- Synchronization of Existing Processes
- Investment Balance Reviews
- Small Business Innovative Research
- Acquisition of Services Policy
- Systems Engineering Excellence
- Award Fee and Incentives Policy
- Enterprise Risk Assessment Model Initiatives
- Open, Transparent and Common Shared Data Resources with Defense Acquisition Management Information Retrieval
- Contingency Contracting Initiatives
- Continuous Process Improvement
- Risk Based Source Selection
- Restructure the Defense Acquisition Executive Summary Reviews

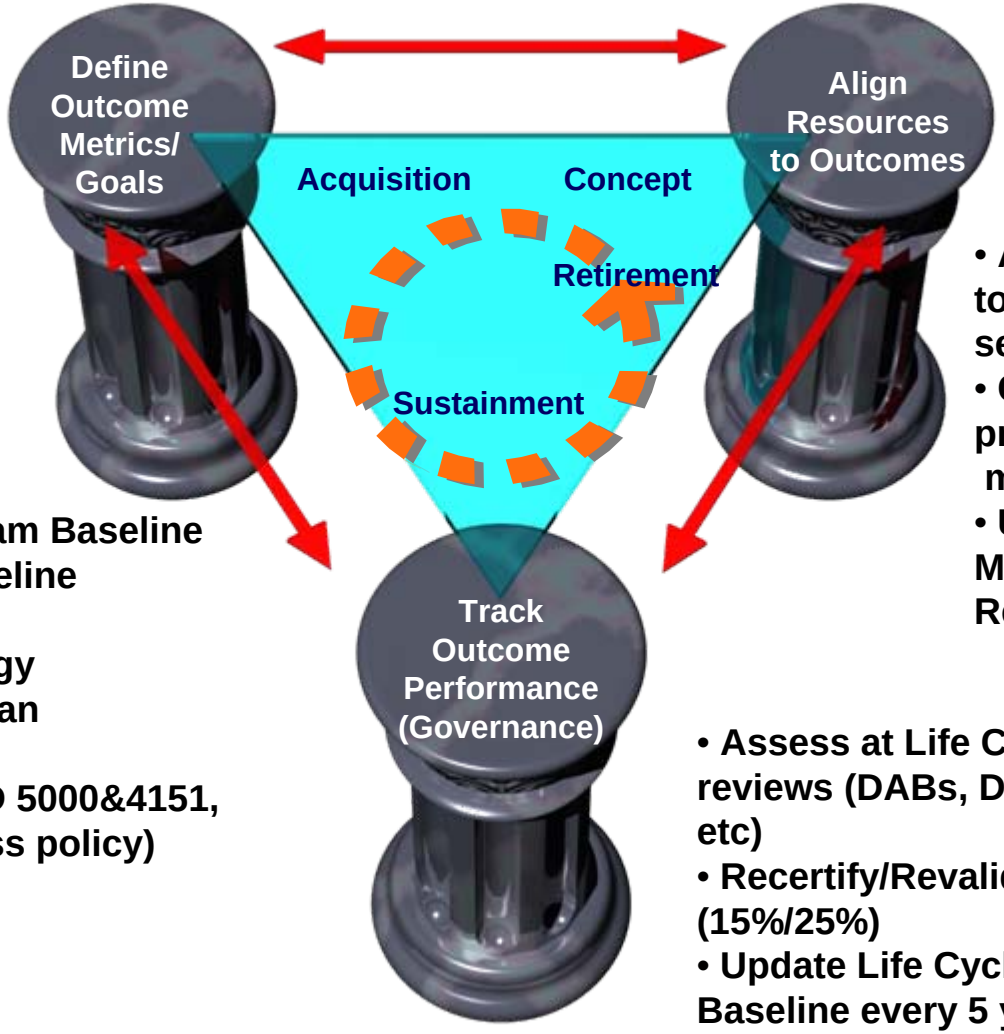
Initiatives ~ Budget

- Planning, Programming, Budgeting, and Execution through a realistic process
- Program Assessment Rating Tool
- Develop authoritative information sources to provide more accurate cost data
- Wide Area Workflow system expansion
- Establish a new online training course for Program Managers and staff leaders regarding effective meetings to support oversight and the review process
- Institute Capital Accounts
- Optimize the Defense Acquisition Board
- Optimize/Eliminate Integrated Product Team process

Initiatives ~ Industry

- Establish baseline criteria for the industrial base
- Reduce certain barriers to entry for non-traditional defense companies
- Improve access to commercial technology
- Better understand and address barriers to entry by reaching out to industry
- Identify strengths and weaknesses in the Small Business Program
- Evaluate contractor vertical integration policies
- Promote innovation and competition by directly funding innovation in science and technology accounts

E X A M P L E
Integrate Life Cycle Principle for Warfighter Materiel Readiness @ Best Cost



Outcomes
- **Materiel Availability**
- **Materiel Reliability**
- **Mean Down Time**
- **Ownership Cost**

Expand Acquisition Program Baseline to Life Cycle Program Baseline

Expand Acquisition Strategy to Life Cycle Strategy Plan

Include in Policy (e.g., DoD 5000&4151, CJCSI 3170, New Readiness policy)

- **Assess resource-to-outcome sensitivities**
- **Create/Use predictive modeling tools**
- **Update Financial Management Regulation**

- **Assess at Life Cycle executive reviews (DABs, DAES+, MRUs, etc)**
- **Recertify/Revalidate upon breech (15%/25%)**
- **Update Life Cycle Program Baseline every 5 yr**

Bottom Line - THINK NEW

•Acquisition Life-Cycle – identify and protect from “concept” to “fielding.”

-

•Identify the gaps and improve communication.

•Bridge the stove-pipes and create horizontal integration.

•Make the process more consistent and transparent to achieve community cooperation.

•Transformation is an outlook, an attitude, a new way of thinking.

•

ACQUISITION TRANSFORMATION

Section 804 Report

http://www.acq.osd.mil/documents/804Reportfeb2007.pdf

(703) 693-0011

Prompt Global Strike (PGS)

Information Brief

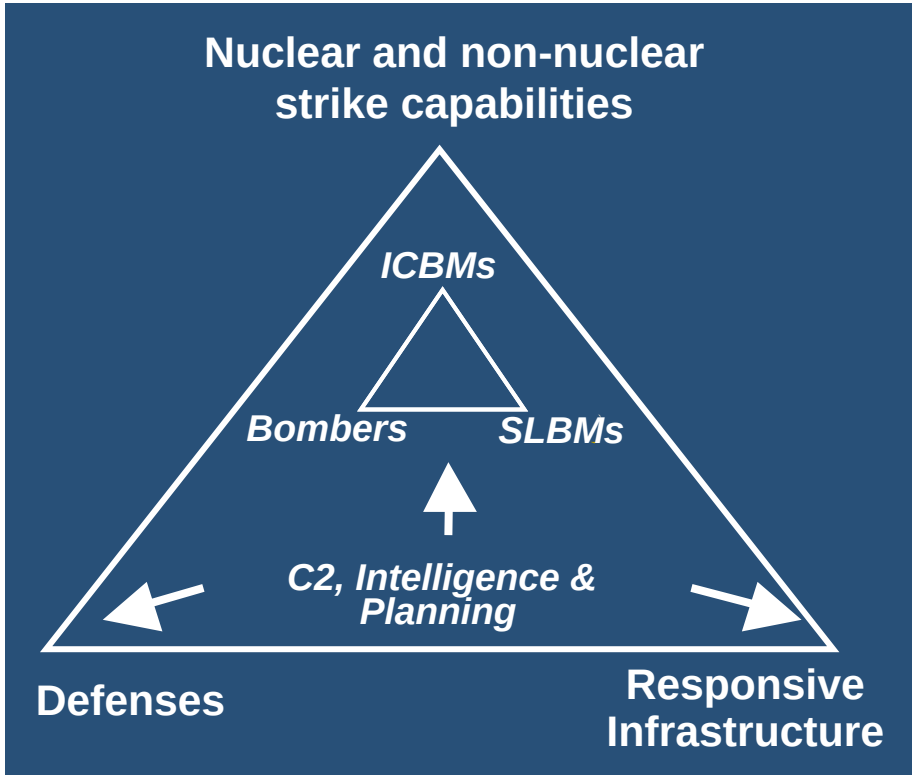
Maj Greg Jones
AF/A5RM
25 Apr 07

Prompt Global Strike (PGS)

- **PGS addresses the capability gap to:**
  - **Strike globally**
  - **Precisely**
  - **Rapidly**
  - **With kinetic effects**
  - **Against high-payoff time-sensitive targets**
  - **Regardless anti-access threats**
  - **With a Conventional Weapon**
- **The capability gap is identified in the PGS Initial Capability Document**
  - **Only option today: Pre-positioned forces or nuclear response (ICBMs and SLBMs)**
  - **It is not "weapons from space"**

PGS is a USSTRATCOM priority that provides rapid conventional strike capability for anti-access and high value targets worldwide

Nuclear Posture Review



- Rapid
- Global
- Precision
- Conventional
- Strike

"I see a great need for a capability that can reach anywhere in the world under an hour...with precise effects."

CDRUSSTRATCOM Feb 05

PGS Capability Gap

Gap identified by:

- **USSTRATCOM Integrated Priorities List**
- **2006 Air Force Capabilities Review and Risk Assessment**
- **Air Force and Joint studies and directives reflected in JROC-approved PGS mission needs statement, May 2003 & JROC-approved PGS ICD, Jul 2006**

The Air Force is working closely w/ USSTRATCOM to fill the PGS capability gap

Critical Capabilities Identified in the PGS Initial Capabilities Document

(1) **Global** - The capability to strike any target set in the world; simultaneously in multiple theaters

(2) **Prompt** - The capability to strike any target set in minutes to hours with no or unambiguous warning

(3) **Precise** - The capability to accurately strike the target and achieve the desired effects

(4) **Range of Effects** – Provide full spectrum effects to influence, dissuade, disrupt or defeat without resorting to nuclear fission or fusion weapons

(5) **Counter Anti-Access** - The ability to penetrate or circumvent anti-access capabilities (military and political), as necessary

Air Force PGS initiatives

- AF is currently working two interrelated initiatives to address the PGS capability gap
  - (1) AFSPC engaged in a PGS technology demo program
    - Designed to evolve, mature, and integrate critical PGS technologies
    - Supports the Command's vision for fielding a mid-term (FY14/15) Conventional Strike Missile (CSM) capability
    - As envisioned, CSM will use existing commercial/excess rocket motors to boost a medium-lift to drag hypersonic glide vehicle
    - Capable of dispensing requalified off-the-shelf munitions at global ranges from the CONUS
  - (2) PGS Analysis of Alternatives (AoA) is a joint study led by AFSPC
    - Scheduled for completion in Mar 08
    - Examines long-term (FY2020 and beyond) materiel solutions

Two phased approach addressing the mid and far term

Conventional Strike Missile (CSM)

- **CSM is AFSPC/CC's vision to deliver a limited PGS capability**
  - **AFSPC Demonstration Program**
  - **Uses commercial/excess rocket motors with proven avionics, transitions to a "family of motors" derived launch platform**
  - **Leverage demo technologies from hypersonic flight tests**
  - **Utilize existing off-the-shelf weapons**
  - **Potential for residual capability**
- **CDR/USSTRATCOM, "very excited…do it faster…keep it simple…integrate CSM into testimony and posture statements."**

CSM is AFSPC/CC's vision (material solution) to fill the USSTRATCOM JROC validated PGS gap by 2014

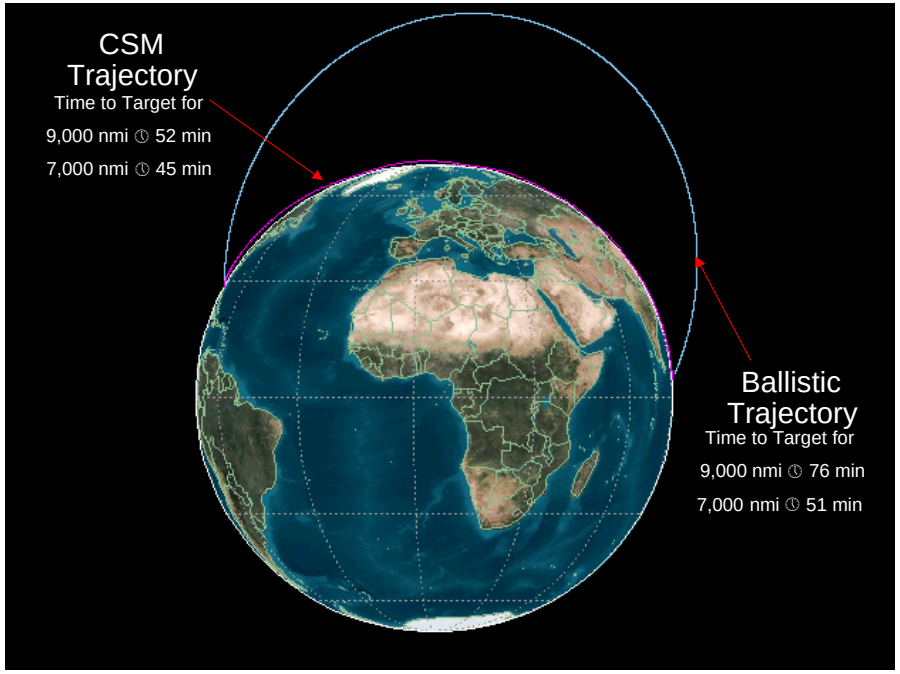
Nuclear vs Conventional Signatures

- Geographically separate basing (Coastal vs Northern tier)
- On-site inspections
- Nuclear-conventional firewalls -- unique/separate C2
- Non-provocative mission planning
- Unique trajectories

Packaging a suite of mitigating measures

Flight differences between the Hypersonic Glide Vehicle (HGV) and a Ballistic Reentry Vehicle

- **The HGV has a completely different flight profile then a ballistic reentry vehicle (RV)**
- **HGV flies a depressed trajectory compared to a ballistics RVs high trajectory**
- **HGV maneuverable (2 to 1 lift to drag) over 50% of flight time; ballistic RVs not maneuverable**
- **RV's located at Northern Tier bases; CSM's to be located at geographically separate coastal bases**



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The HGV has a completely different profile and trajectory then a RV

Information Sharing in the GIG Environment and the C2 Perspective

24 April 07

Precision Strike Conference

People throughout the trusted, dependable and ubiquitous network are empowered by their ability to access information and recognized for the inputs they provide.

Build, Populate, Protect

C3-NII

Topics

- GIG Basis
  - Vision and Objectives
  - Overall architecture and GIG structure
- Key GIG Tiers
  - Transport
  - Enterprise Services
  - Applications
    - Illustrate how SOA operates in the GIG architecture
- C2 Structures – New (SOA) vs Old (Tightly coupled)
  - Technical approach
  - Implementation aspects
  - Future direction
- GIG delivery considerations
  - Commercial and military
  - Differences in IT approaches

Background

C2 Considerations

Future

Topics

- The GIG Architectural Construct
  - Feature attributes of the GIG and netcentricity
  - Differences from past implementation approaches to the future GIG
- C2 Architectural Perspective
  - New C2 governance and implemention approaches
  - The relationship of C2 within the GIG
  - The importance of SOA and SLA to C2
  - Critical consideration of data to C2
- Understanding the Transport Layer
  - A key enabling element for C2
  - The separation of transport and C2 applications
- Identifying How C2 is Enabled by the Network
  - Tactical edge approaches to networks
- The future C2 application set is NECC
  - Characteristics and implementations

The GIG is All About

Information

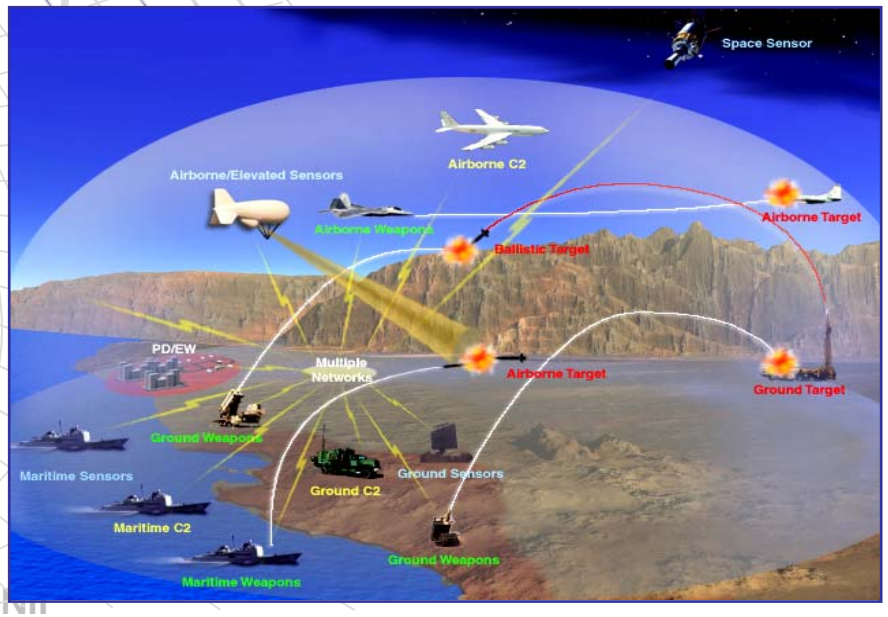
- Assured
- Timely
- Highly Available
- Right - Needed

The NII emphasis is shifting from the establishing transport programs to the network, services and applications perspective

Net-Centric Vision *(Define the End Point)*

- ***Vision – Power to the Edge***
  - People throughout the trusted, dependable and ubiquitous network are empowered by their ability to access information and recognized for the input they provide.
  - To enable and empower people at the edge of the network
- **Goals**
  - **Goal #1 – Make information available on a network that people can depend upon and trust**
  - **Goal #2 - Populate the network with new, dynamic sources of information to defeat the enemy (post before you process)**
  - **Goal #3 - Deny the enemy comparable advantages and exploit weaknesses**

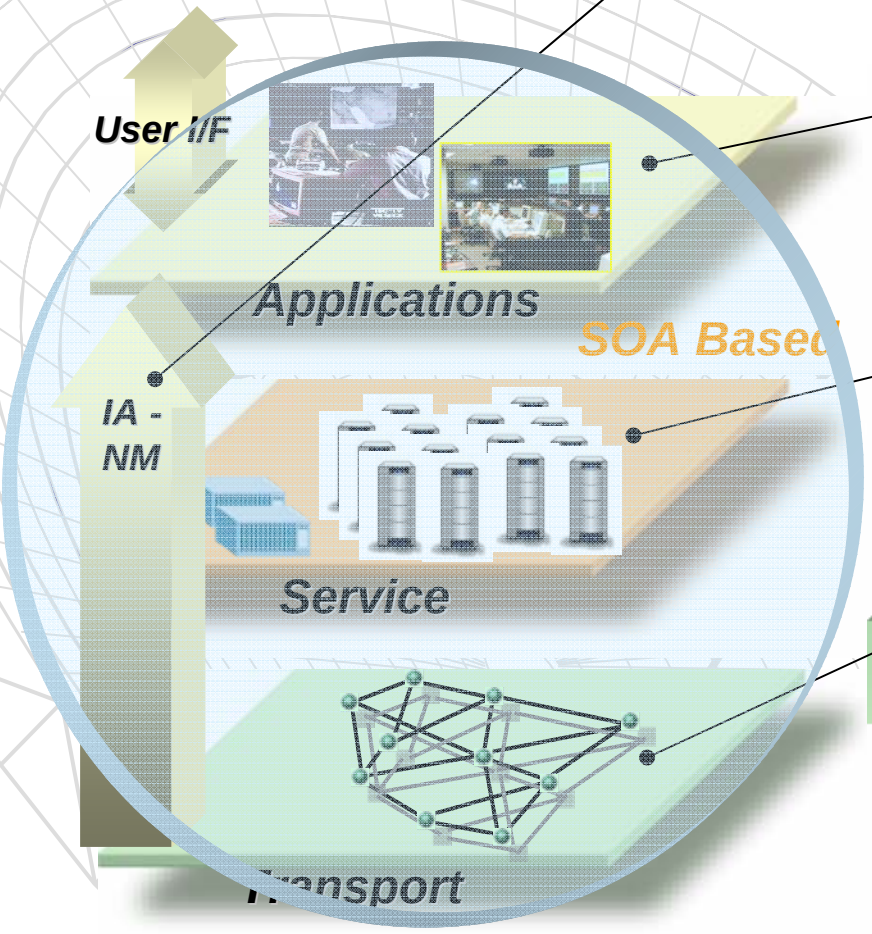
- **A robust networked force leads to information sharing**
  - **Enhancing the shared situational awareness in support of the commander's intent**
- **Achieved by leveraging the commercial information transformation**
  - **Information is more than a technology**
  - **Evolution of capability – being measured daily**



C3-NII

GIG Perspective

Information & the GIG - Layered Perspective



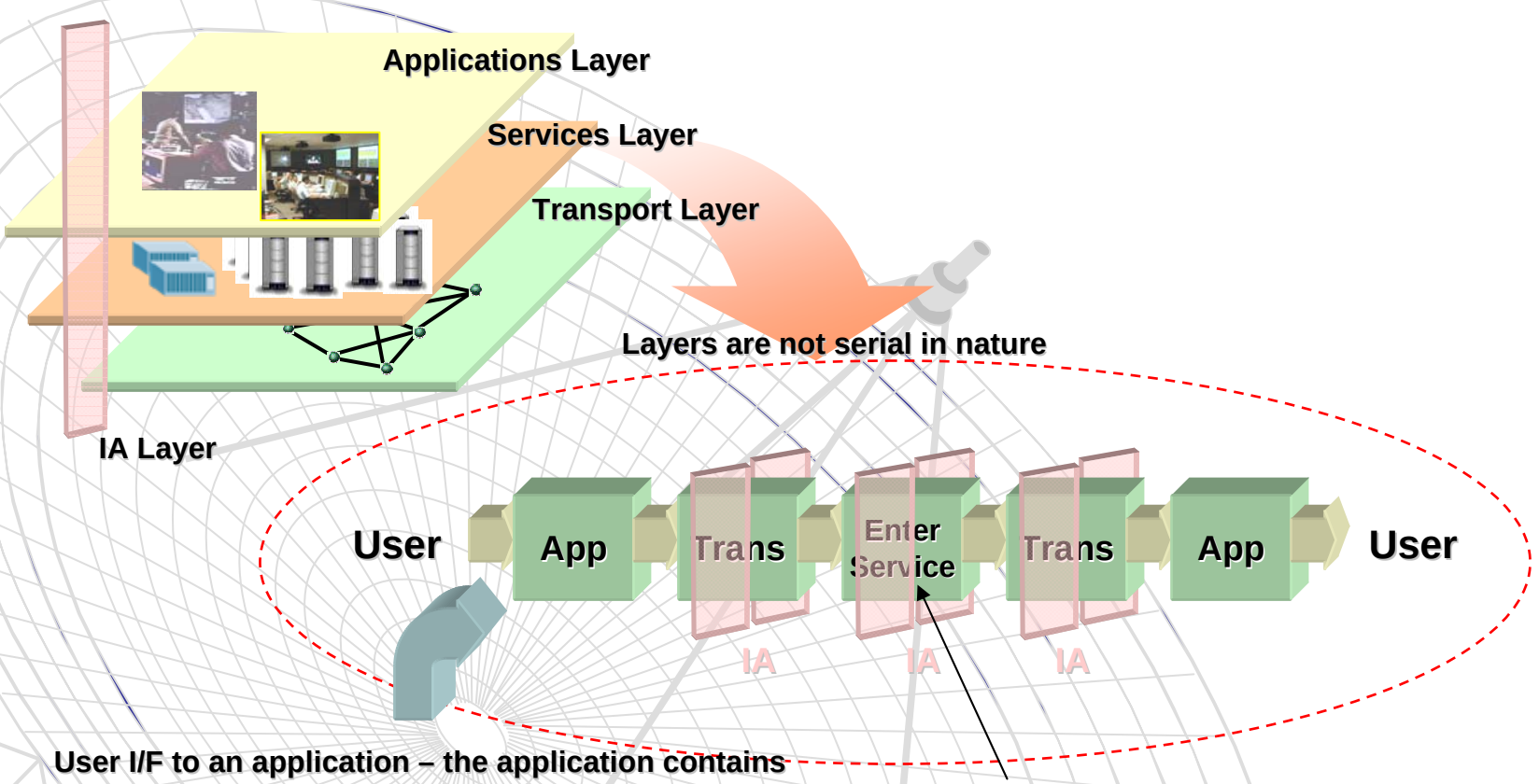
- ✓ Loosely coupled applications based upon SOA/SLA
- ✓ Enabled applications are highly adaptive and flexible

- ✓ Defined data strategy – attributes set by applications
- ✓ XML driven by DoD directives
- ✓ SOA enterprise environment with managed services

- ✓ IP based with QoS established by applications
- ✓ Multi-media for highly available communications

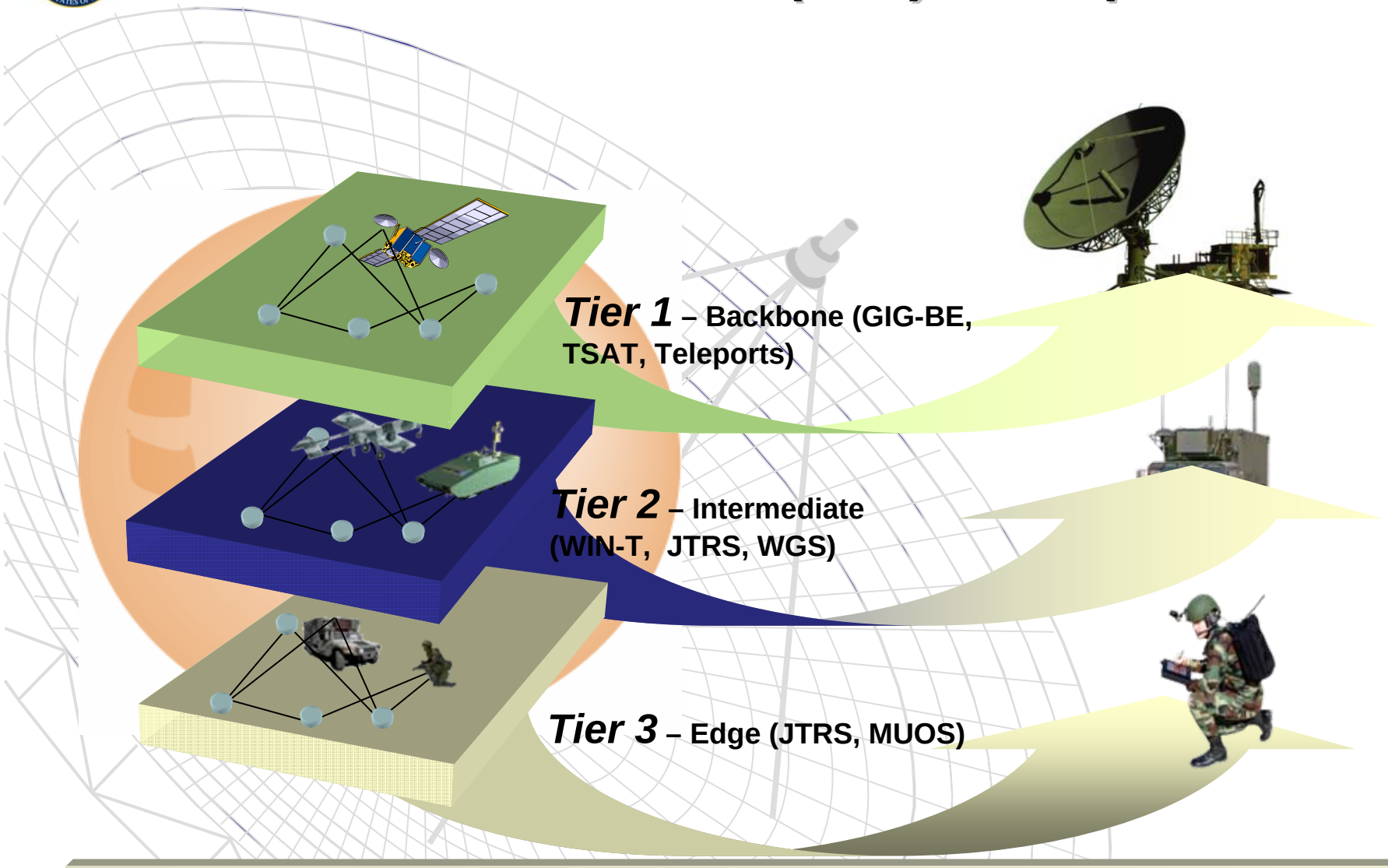
Assured information (data) access is the critical concept – the user sets the information access requirements

A GIG Functional Dissection



- The Layers are not sequential as layered perspective
- Services and application layer rarely are interfaced (I/F) directly
- Transport has minimally knowledge or intelligence while application is knowledge element

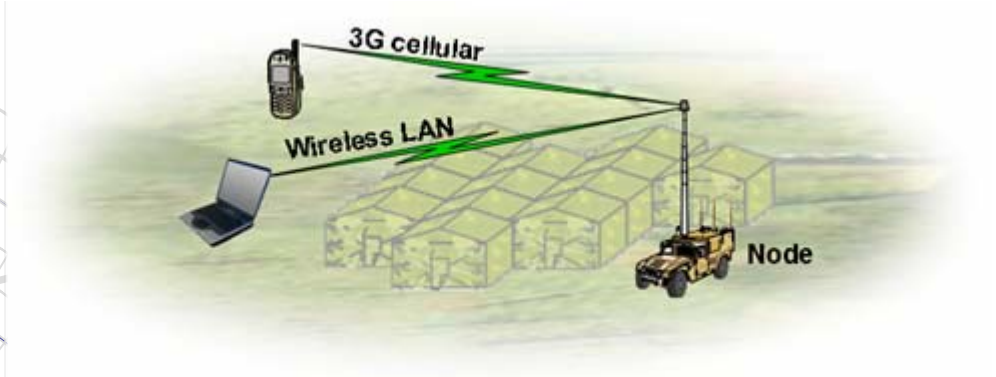
Global Information Grid (GIG) Transport Tiers

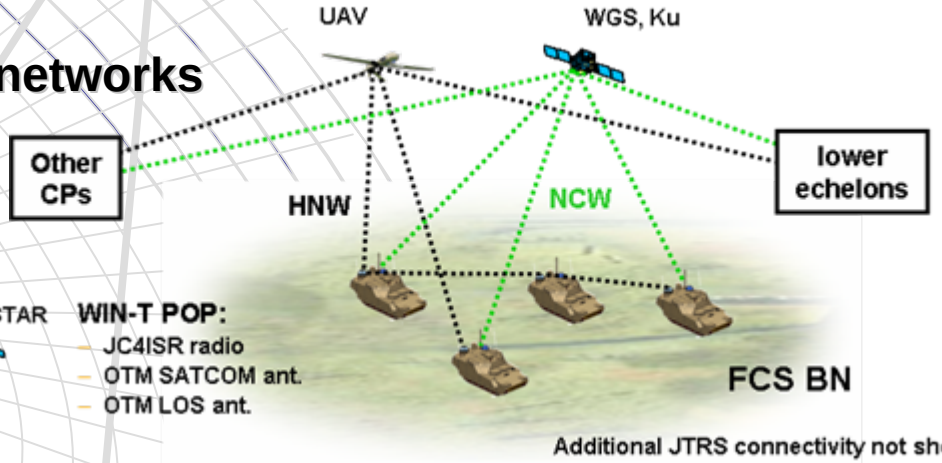


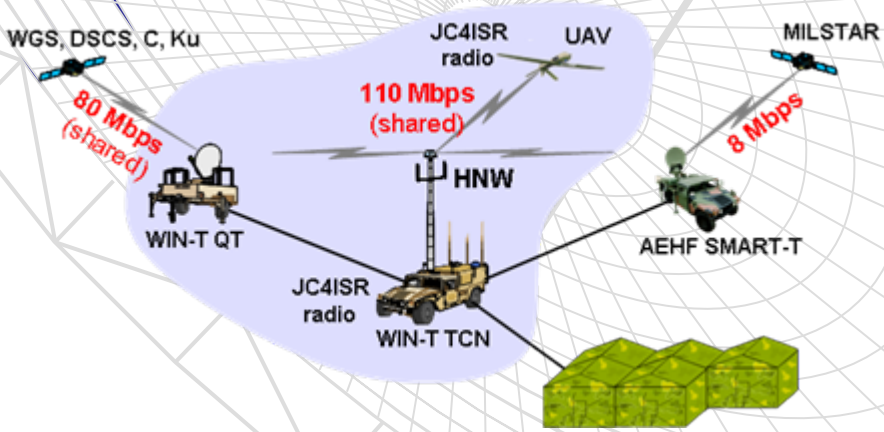
- GIG is an IP unified network having a BLACK routing and switching basis – tier in many respects as commercial networks

Key GIG Communications Network Component Programs

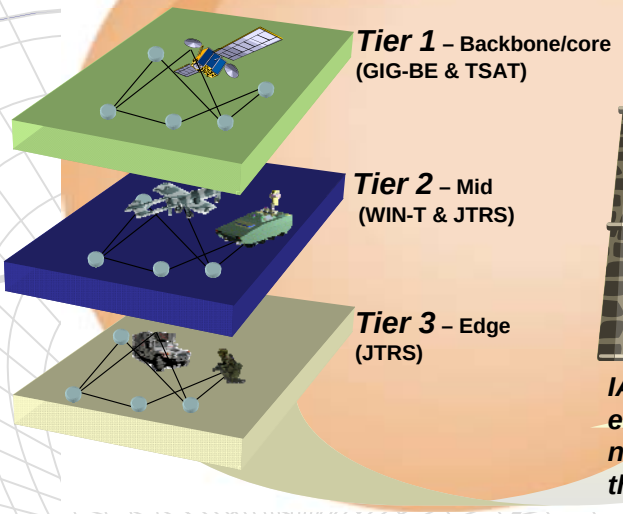
- DISN-NG (GIG-BE)
- SATCOM
  - TSAT & AEHF
  - WGS - WIN-T/JNN
  - MUOS
  - HC3, NMT, FAB-T
- Tactical terrestrial equipments / networks
  - JTRS
  - WIN-T
  - CDL and variants

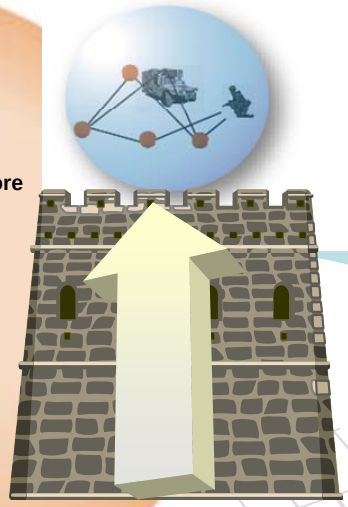






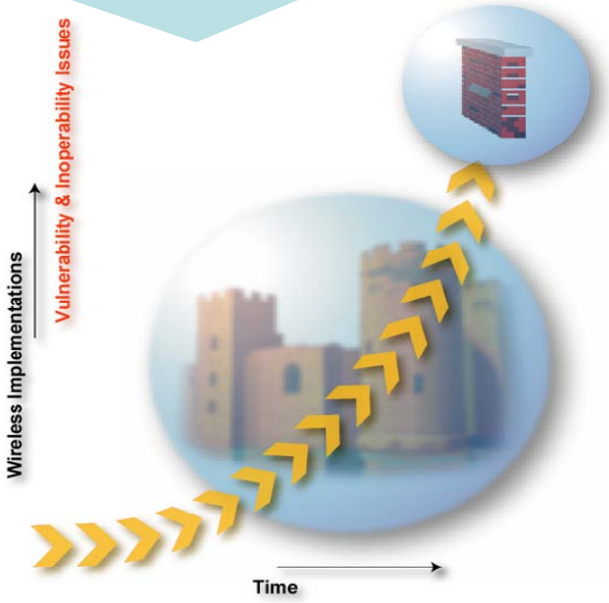
GIG Transport Tiers and IA





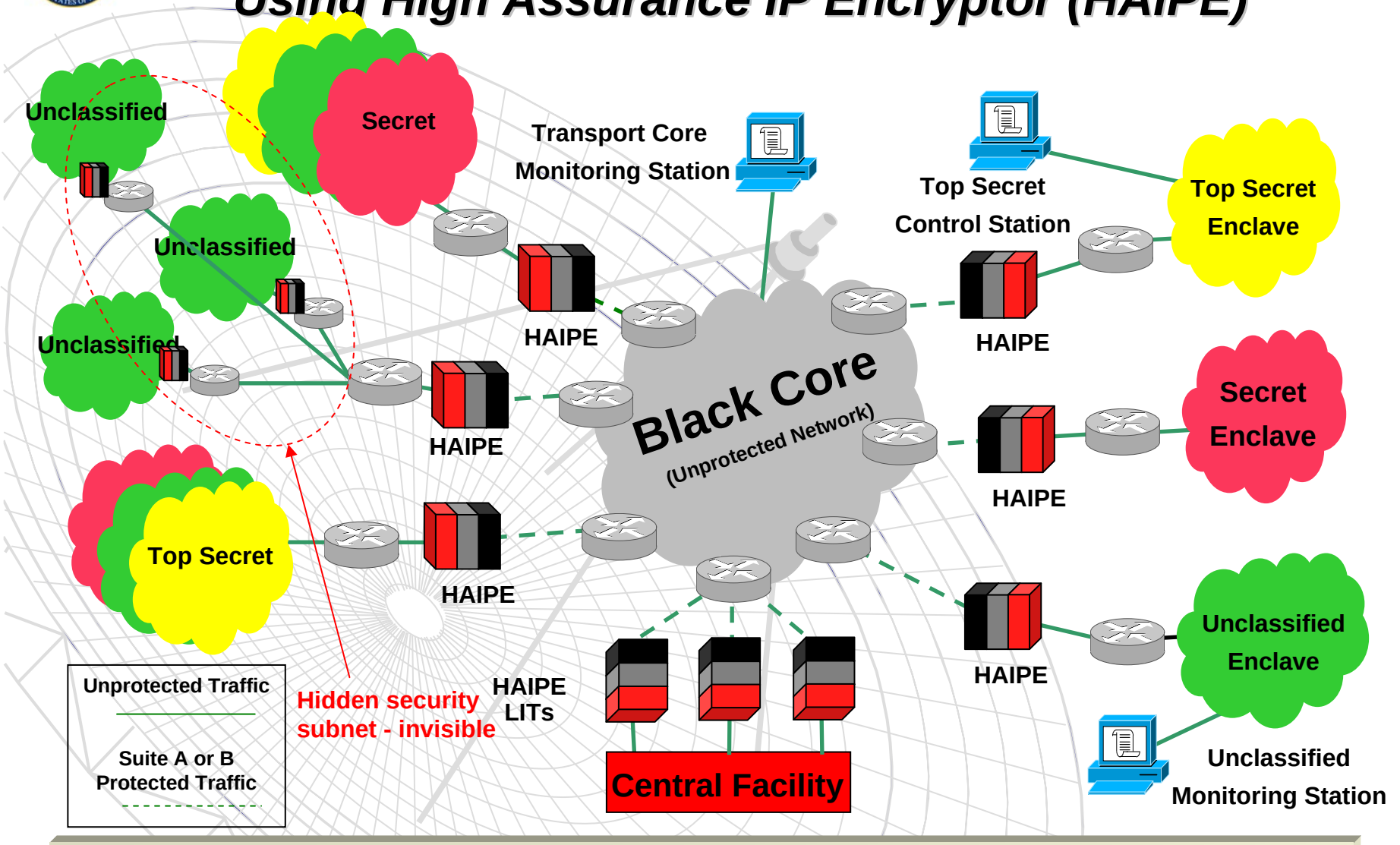
IA – Remains a major element to a unified GIG network – protection of the network & information

- **System IA challenges**
  - BLACK IP routing
  - Key management
  - Data and CDS access
  - Application assurance
- **Solution – Integrated IA**



The GIG is more than an all IP unified network - contains architectural security (IA) based on an integrated IA enterprise solution

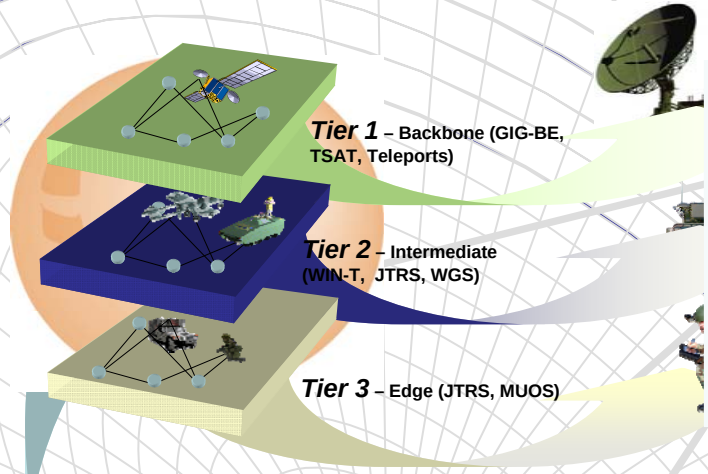
Securing The Network:
Using High Assurance IP Encryptor (HAIPE)

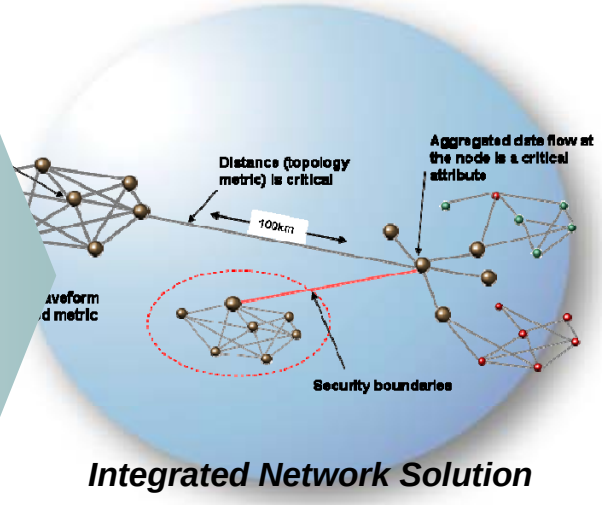


IA is not confined to the transport mechanism, but includes the key enterprise services including access and CDS considerations

Incomplete Network Solution - Losing Sight of the Network

Network Topology Relationships



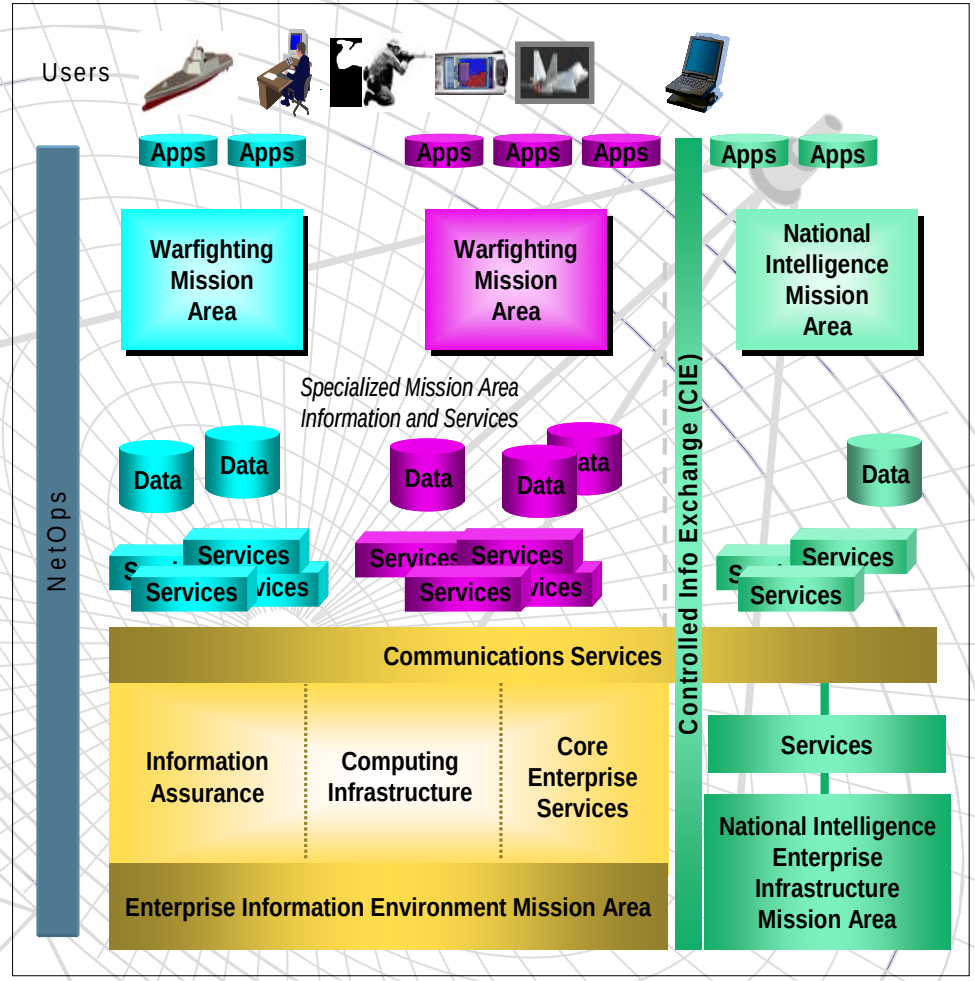


Integrated Network Solution

- Understanding the entire network is critical so to not compromise a cost and warfighter effective solution (Interoperability)
- Forcing the core and tactical edge networks to be addressed an integrated structure
- Network and Enterprise programs are NOT independent
- Network is part of the GIG – requires relationship to the services and applications, BUT information (data) is the critical element
- Interoperability with more than a single Service element or a partial force – total force including the all Services and coalition forces

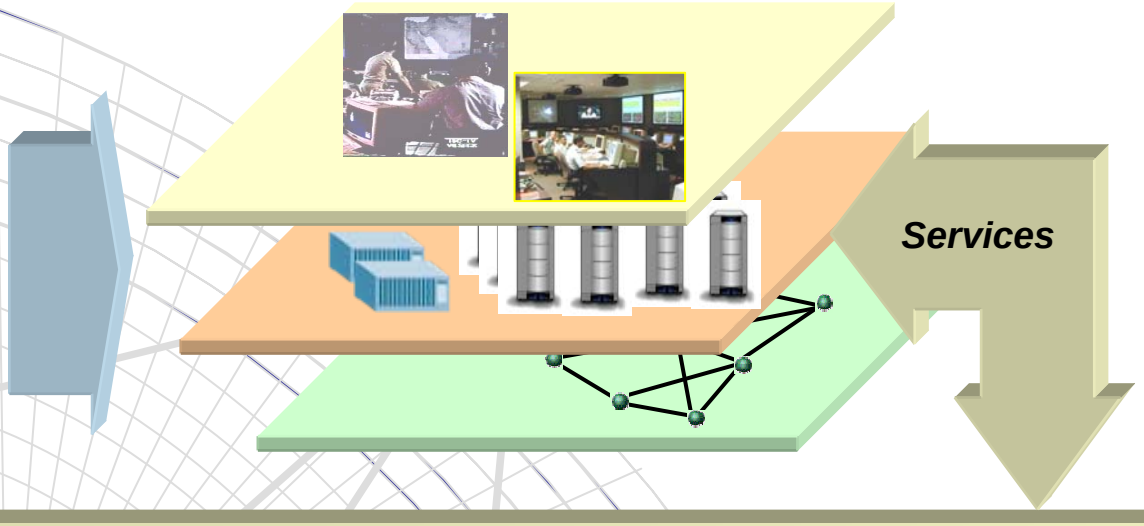
DoD Services Vision

DoD Net-Centric Environment (NCE) will evolve to an enterprise SOA



- **Supported by the required use of a common and shared infrastructure provided by the EIEMA**
- **Populated with mission and business services provided and used by each Mission Area**
- **Governed by a cross-Mission Area board chaired by the DoD CIO**
- **Managed via GIG NetOps**

Services - NCES Objectives

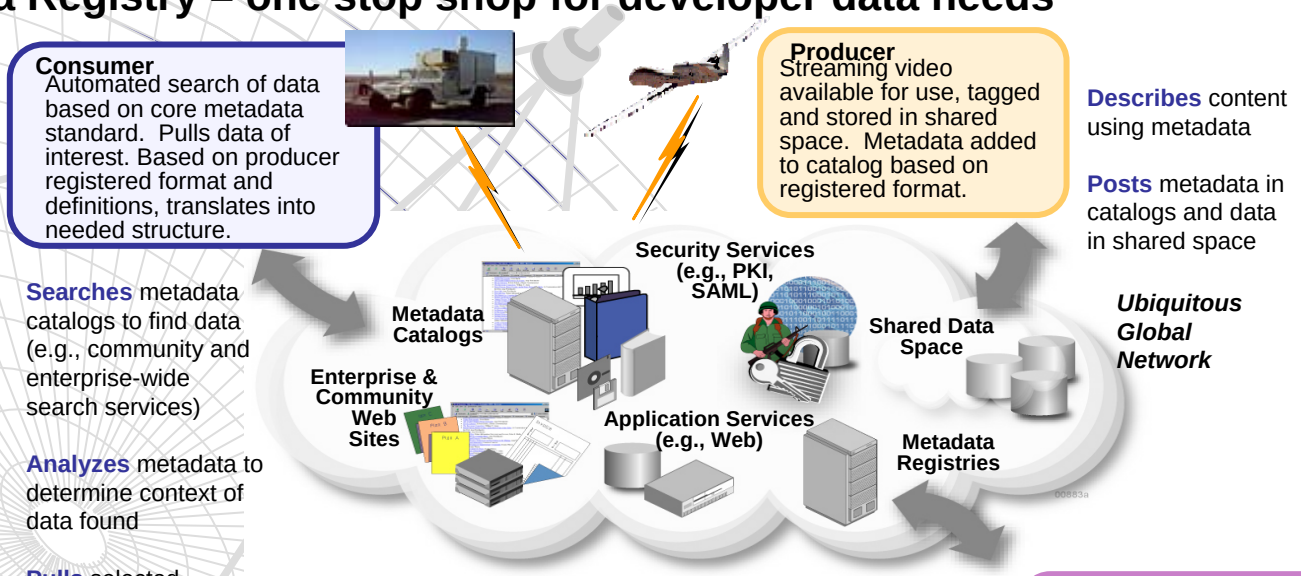


- Deliver capabilities-based service infrastructure for ubiquitous access to timely, secure, decision quality information by edge users
- Enable information providers to post any information they hold
- Enable edge users to:
  - rapidly and precisely discover and pull information resources
  - dynamically form collaborative groups for problem solving
- Provide security for, and coordinated management of, netted information resources
- Data interoperability versus application interoperability

Data Strategy and Enterprise Services Tier

Data Management

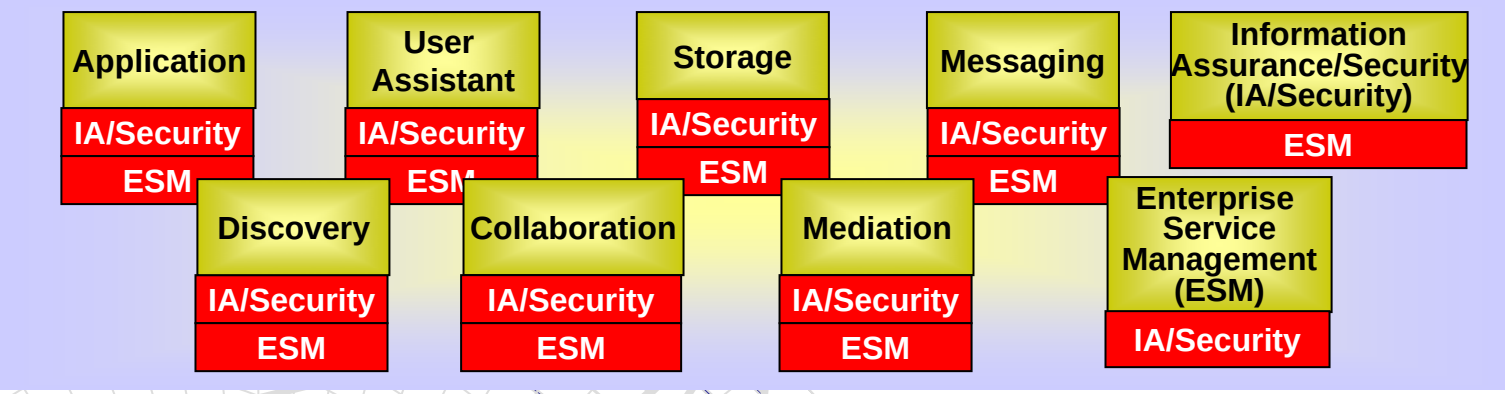
- **DoD Discovery Metadata Standard (DDMS) – enables visibility, understandability and trust for all posted data**
- **DoD Metadata Registry – one stop shop for developer data needs**



Enterprise Services

- **NCES - Storage, cross domain-IA security, collaboration, messaging, discovery, mediation, ESM, applications**

Core Enterprise Services Delivered by NCES



Application - The set of services necessary to provision, host, operate and manage the GIG ES assured computing environment.

User Assistant - Automated capabilities that learn and apply user preferences and patterns to assist users to efficiently and effectively utilize GIG resources in the performance of tasks.

Storage - The set of services necessary to provide on demand posting, storage and retrieval of data.

Messaging - Provides services to support synchronous and asynchronous information exchange.

Collaboration - services that allows users to work together and jointly use selected capabilities on the network (i.e., chat, online meetings, work group software etc.)

IA/Security - The set of services that provide a layer of Defense in Depth to enable the protection, defense, integrity, and continuity of the information environment and the information it stores, processes, maintains, uses, shares, disseminates, disposes, displays, or transmits.

Discovery - services that enable the formulation and execution of search activities to locate data assets (e.g., files, databases, services, directories, web pages, streams) by exploiting metadata descriptions stored in and or generated by IT repositories (e.g., directories, registries, catalogs, repositories, other shared storage).

Mediation - services that enable transformation processing (translation, aggregation, integration), situational awareness support (correlation and fusion), negotiation (brokering, trading, and auctioning services) and publishing.

ESM - services that enable the life cycle management of the information environment and supports the performance of the NetOps activities necessary to operationally manage information flows in the information environment.

Service Oriented Architecture

Invoke

(Bind)

Service Produc

Data and applications available for use, accessible via services. Metadata added to services based on producer's format.

Service Consumer

Automated search of data services using metadata. Pulls data of interest. Based on producer registered format and definitions, translates into needed structure.

- **Describes** content using metadata
- **Posts** metadata in catalogs for discovery
- **Exposes** data and applications as services

- **Searches** metadata catalogs to find data services
- **Analyzes** metadata search results found
- **Pulls** selected data based on metadata understanding

Publish

(Post)

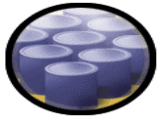
Enabled Int

Discover

(Find)

Service Registries

Messaging Services

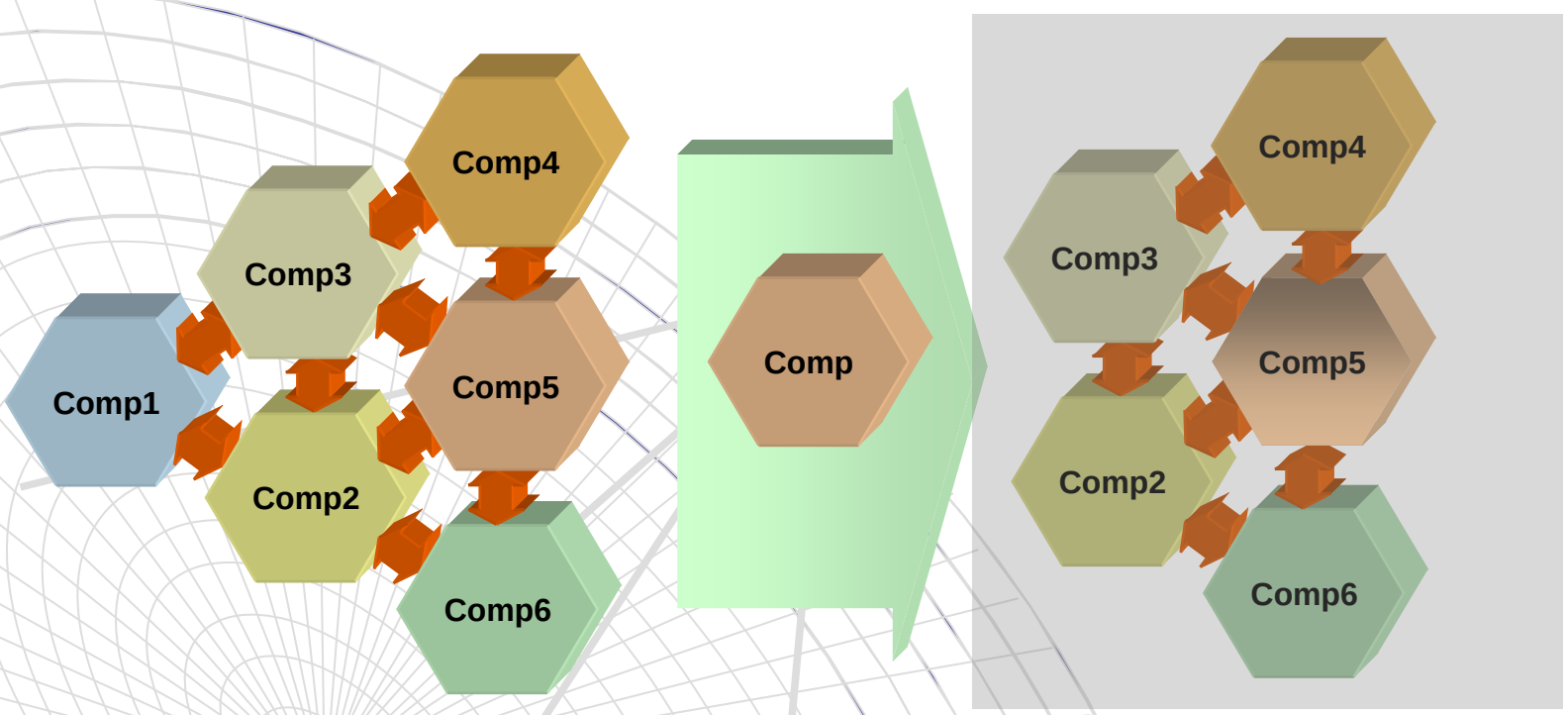


Data Services

Transformation Services

Arch

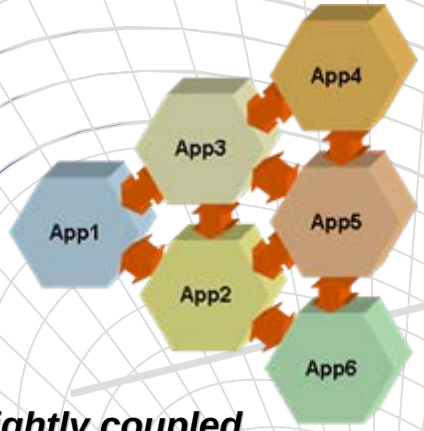
The Tightly Coupled Solution Issue



- Previous system approaches emphasized tightly coupled systems having closely specified interfaces and highly optimized processing flows
  - Unfortunately, changing a single component had effects on numerous other subsystem component
- The JNO is supporting the newer “Internet” approach of loosely coupled system demonstrating rapid adaptability and minimal interface interference/dependence

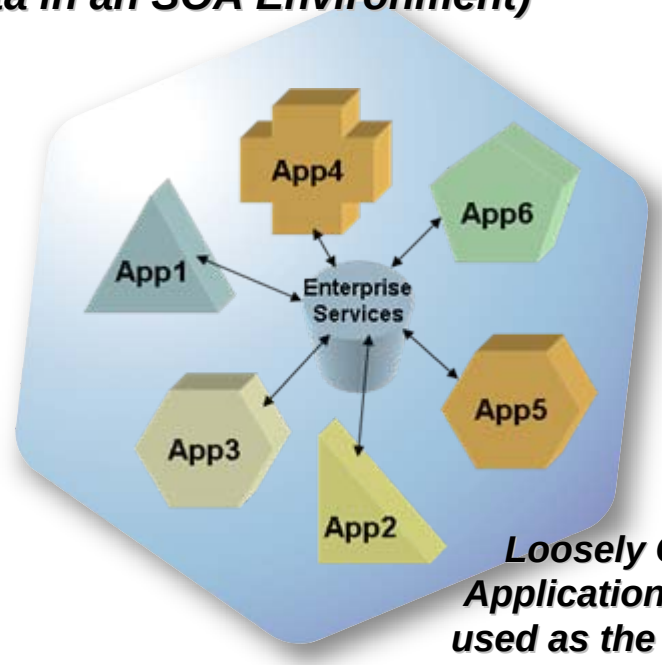
C2 Applications Using Data as the Integrating Element

(The Importance of Data in an SOA Environment)

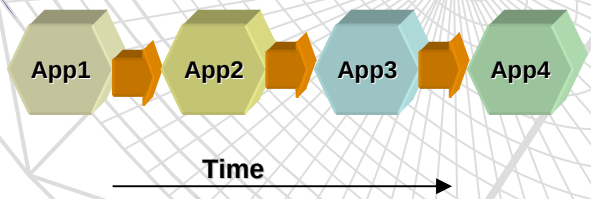


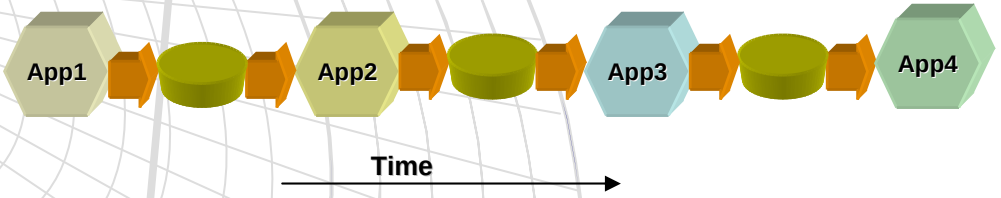
Tightly coupled applications with detailed and interactive interfaces

SOA



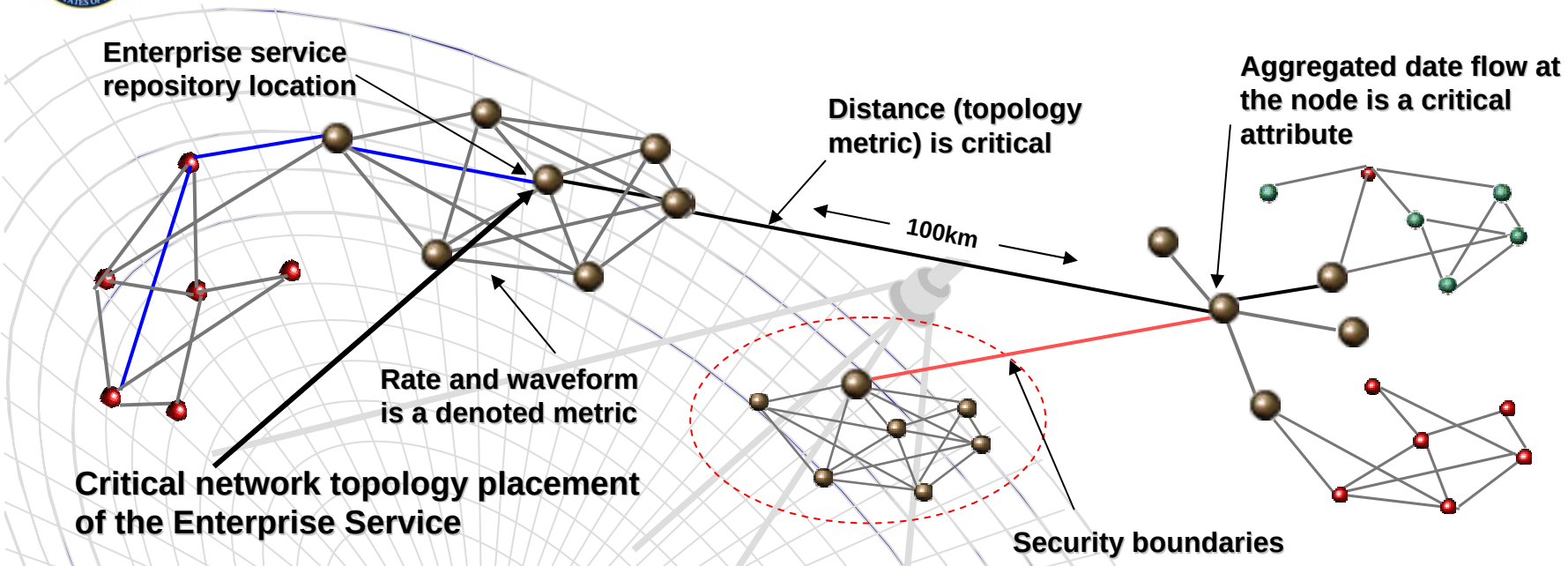
Loosely Coupled Applications – data is used as the integrating element





The use of data as the integrating element instead of fixed physical or database I/F offers extreme flexibility and adaptability

C2 – Network Topology Architecture



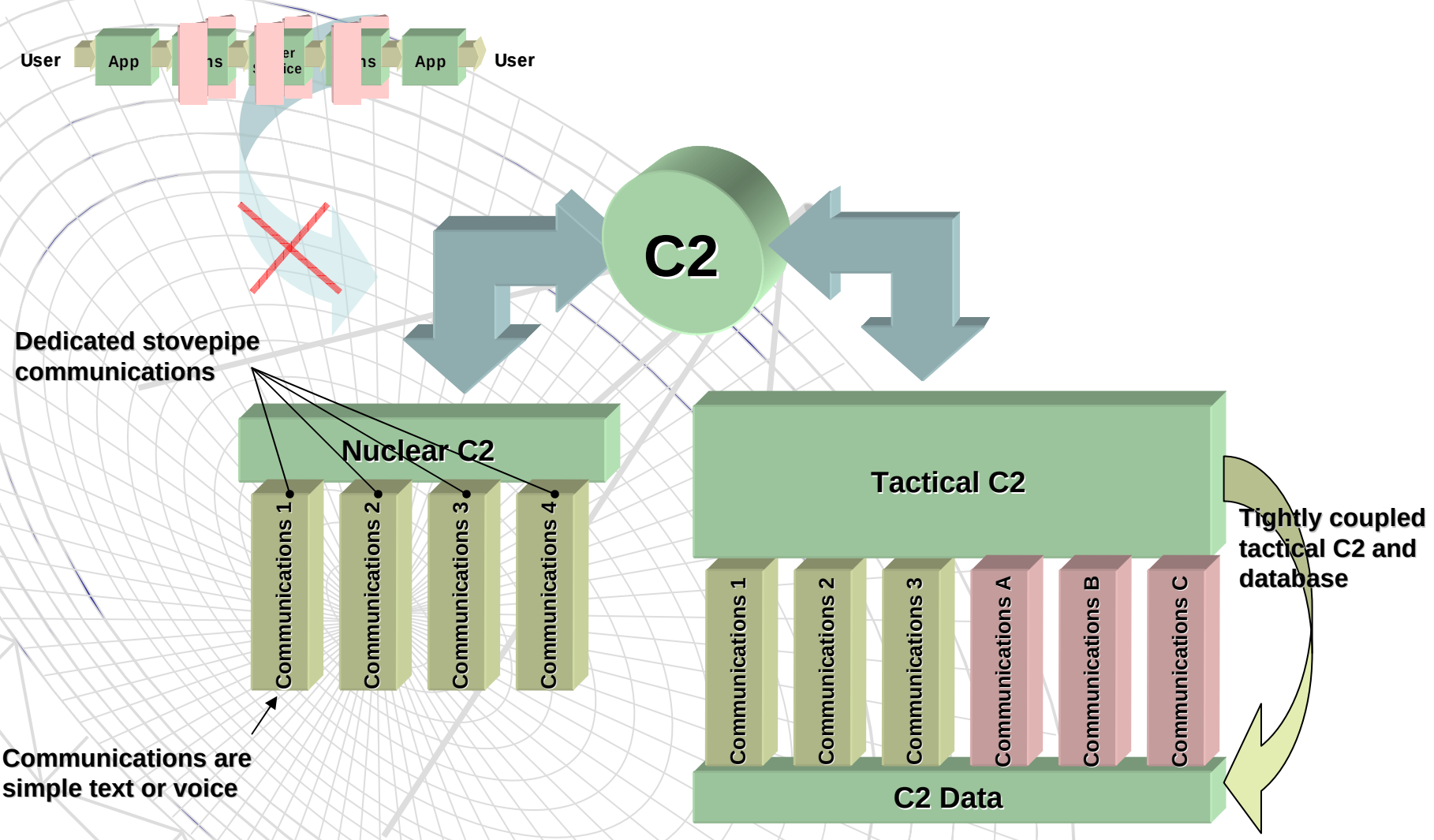
- Understanding the network topology is critical for determining the network performance and application – also to address the fundamental network requirements
  - Often only links solutions are determine without regard for the enterprise requirement
  - The aggregated nodal information flow in relationship to the enterprise services point provides a architectural construct to the network
  - Mobility of the nodes and the connectivity characteristics relative to path / link characteristics is required
- The network topology becomes an important tool for determining not only the network structure and engineering focus but addressing investment and programmatic interoperability issues
  - It is critical to place the topology in a chronological perspective having a minimal three slice views
  - IA including critical protected performance is essential to the successful objectives of a GIG implementation

Data Strategy

Foundation

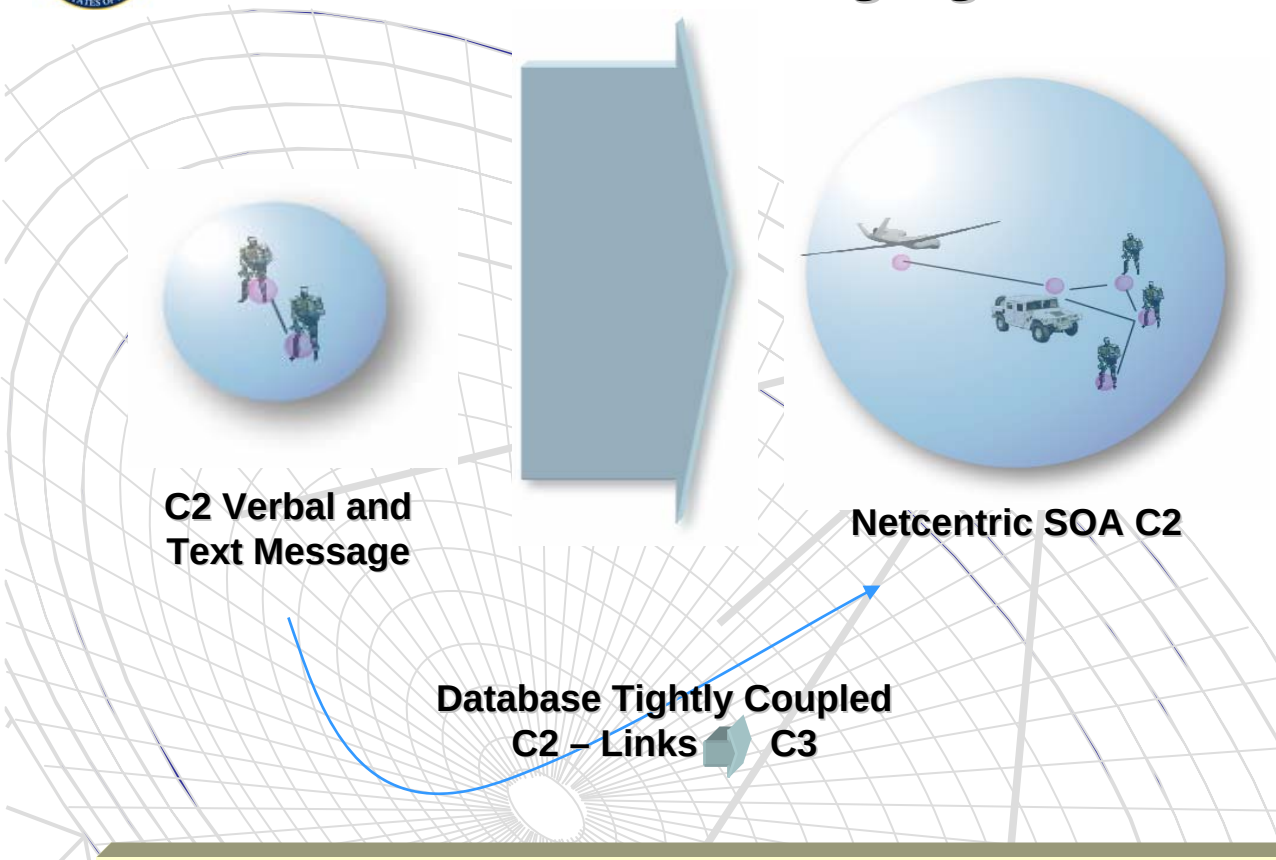
- Ensures data are visible, accessible, and understandable
- Accelerates decision making by having data where needed and when needed
- Accommodates known and unanticipated users
- "Tags" data (intelligence/non-intelligence; raw/processed) with metadata to enable discovery
- Requires data and services registries to describe, post and store
- Posts data to shared spaces for users to access based on identity and role
- Organizes around Communities of Interest (COIs) using a shared vocabulary to exchange information

Past C2 Views and Implementations



- Past C2 systems were tightly coupled – strong coupling to communications and database schemas

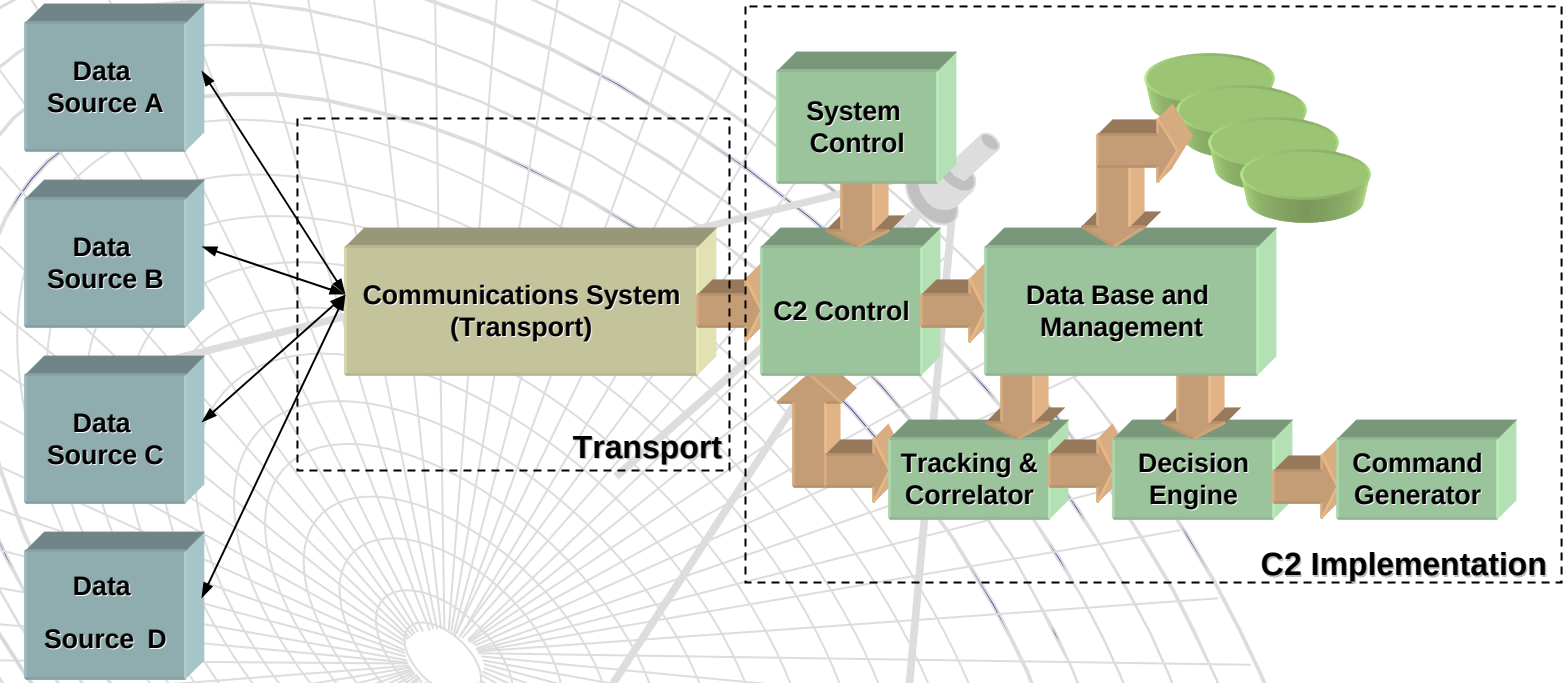
C2 Changing Environment



- Enabling connectivity
- Commercial implementation based on loosely coupled apps
- Data methodology enabling distributed repositories
- Service Level Agreements offered commercially

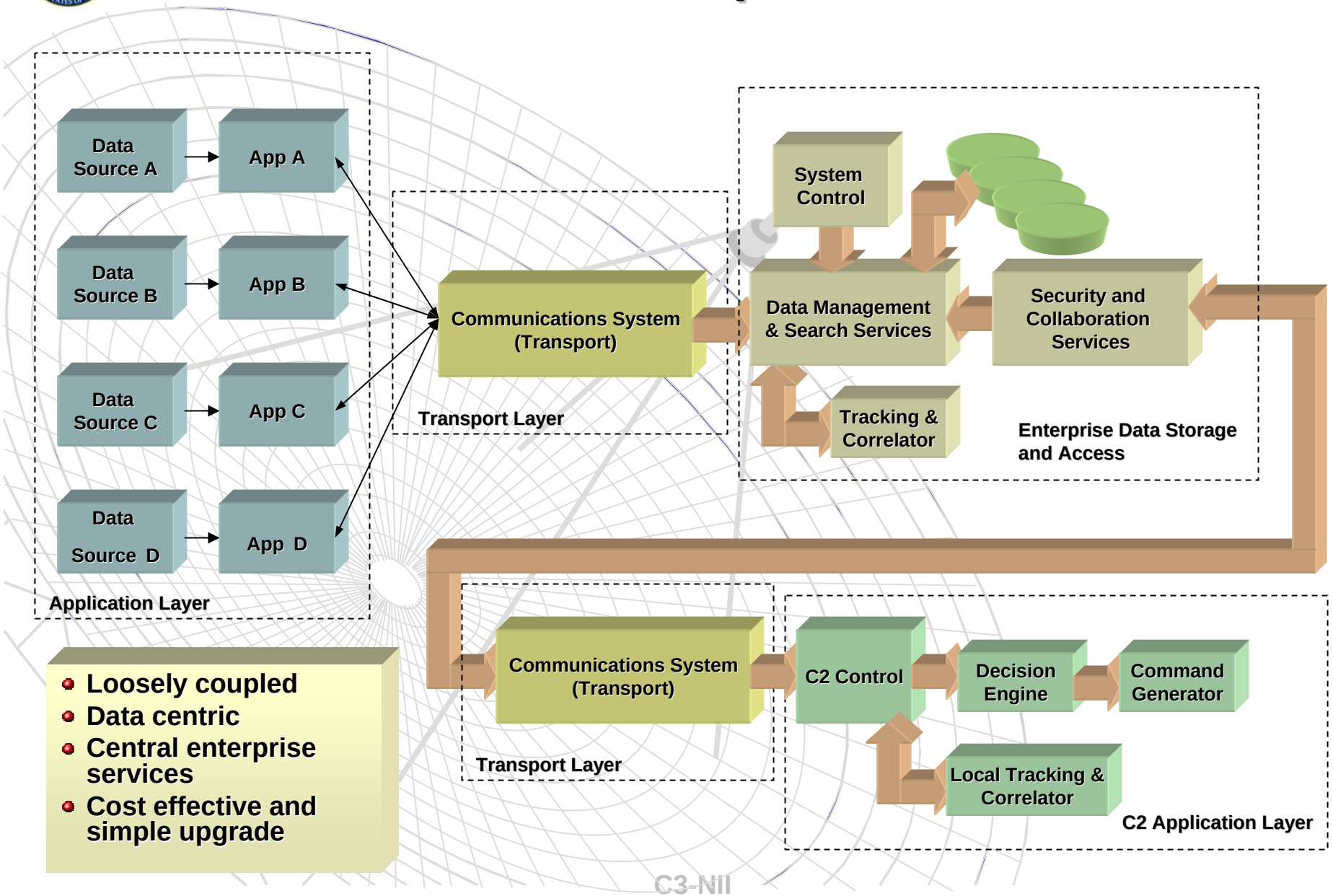
- **Past C2**
  - Given: voice/text capability C2 = voice or text message required C3
- **Netcentric C2**
  - Given: enabling connectivity C2 = applications required data access
  - Emphasis is on tagged data in a SOA structured implementation with SLAs
  - Treatment of C2 as an application with emphasis on data attribbute definition and data importance

Past Typical C2 Perspective



- Database is tightly coupled with the data sources through a dedicated communications subsystem.
- All of the C2 functional components are highly dependent and tightly integrated into a highly tuned system

Netcentric C2 Implementation



- Loosely coupled
- Data centric
- Central enterprise services
- Cost effective and simple upgrade

ECMs Support Mission Threads

Time Sensitive Targeting Mission Thread example

The Warfighter Owns and Shapes The mission thread

Guides ECM Development

Establishes Integration Environment

Operational construct For testing & assessment

Mission Thread

Find, Fix, Track, Target, Engage, Assess

Mission Thread

WHAT

FIND

FIX

TRACK

TARGET

ENGAGE

ASSESS

Evaluation Capability Modules (ECMs)

HOW

Geospatial Information Search ECM

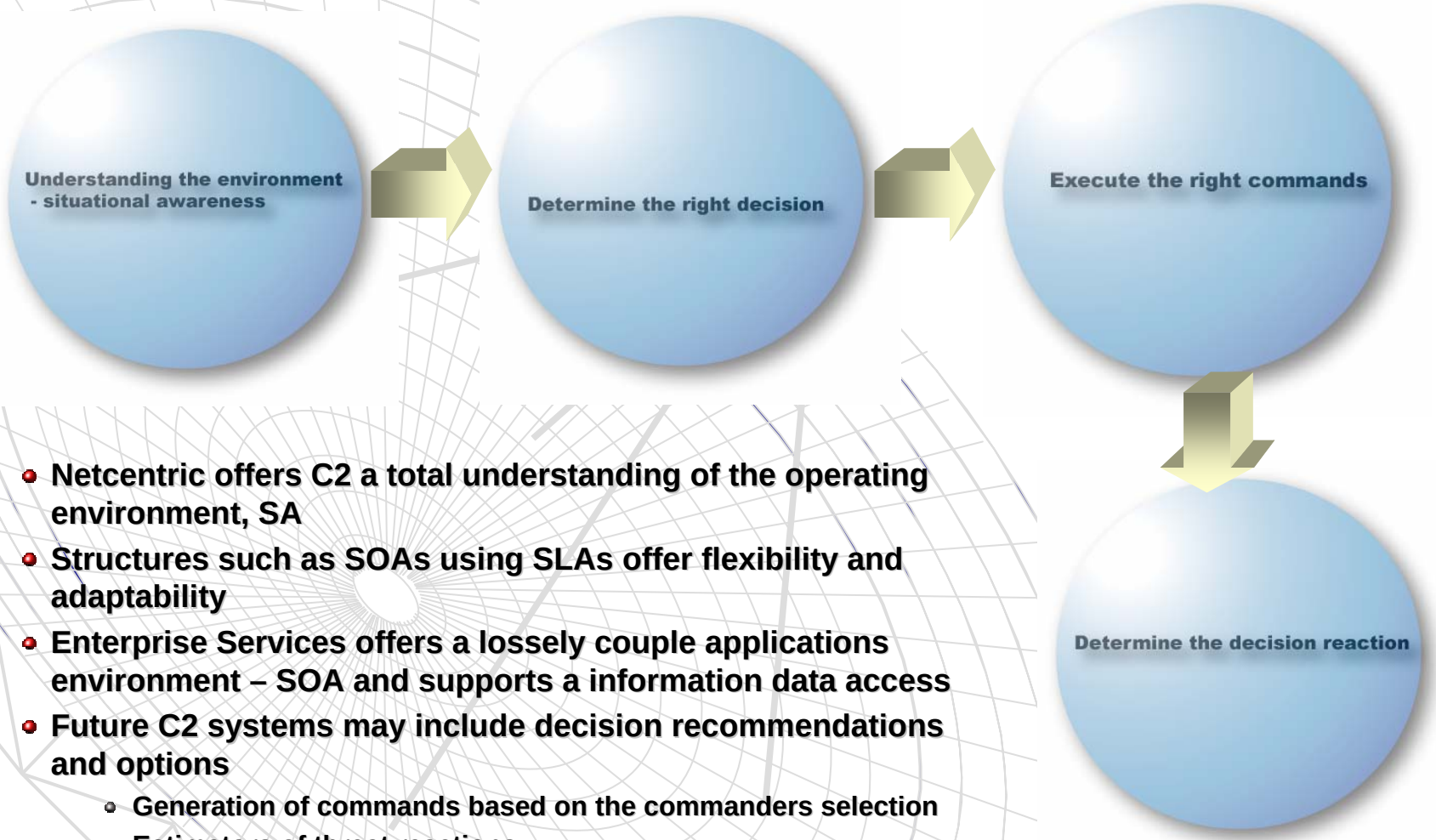
Operational Context ECM

Attack Analysis ECM

Weapons Target Pairing ECM

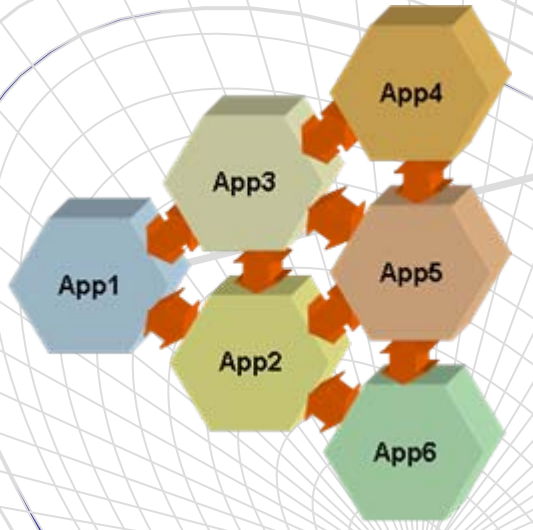
UAV Video ECM

Future C2 Implementations



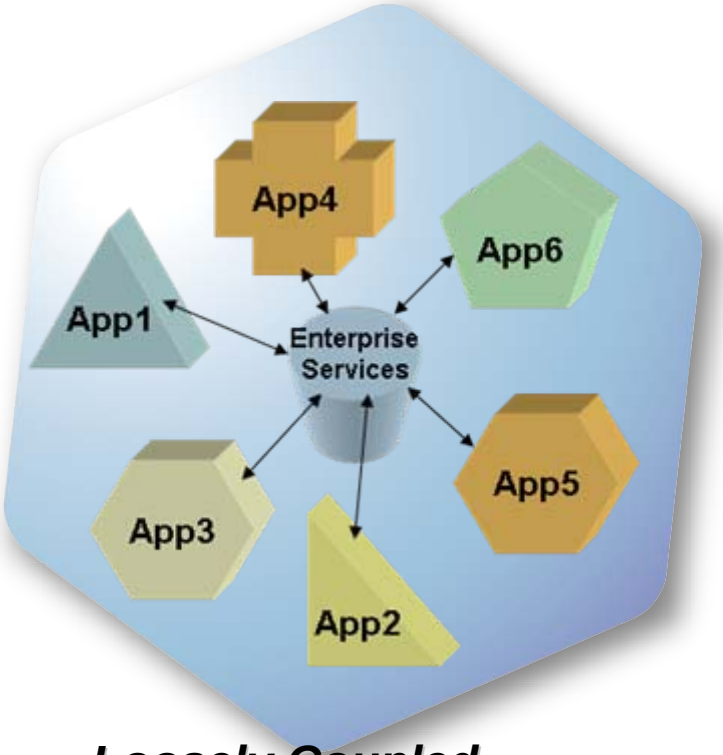
- Netcentric offers C2 a total understanding of the operating environment, SA
- Structures such as SOAs using SLAs offer flexibility and adaptability
- Enterprise Services offers a lossely couple applications environment – SOA and supports a information data access
- Future C2 systems may include decision recommendations and options
  - Generation of commands based on the commanders selection
  - Estimators of threat reactions

Applications Transformation to an SOA Environment



Tightly Coupled Applications

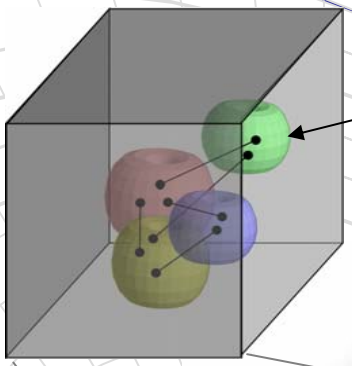
SOA Transformation



Loosely Coupled Applications

The transformation to an SOA has enabled a massively different approach to C2 and other applications as being demonstrated by NECC

Application Development Transformation



Evaluation Capability Modules (ECMs)

Operational Capability Modules (OCMs)

Sandbox

Development

Development Piloting

Operational Piloting

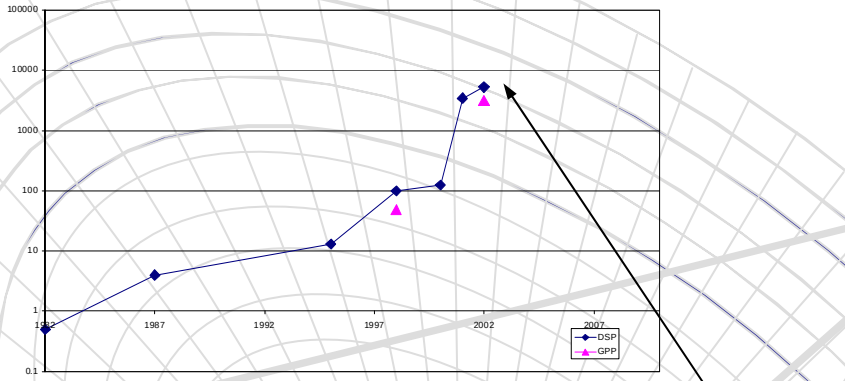
Operational Maturity →

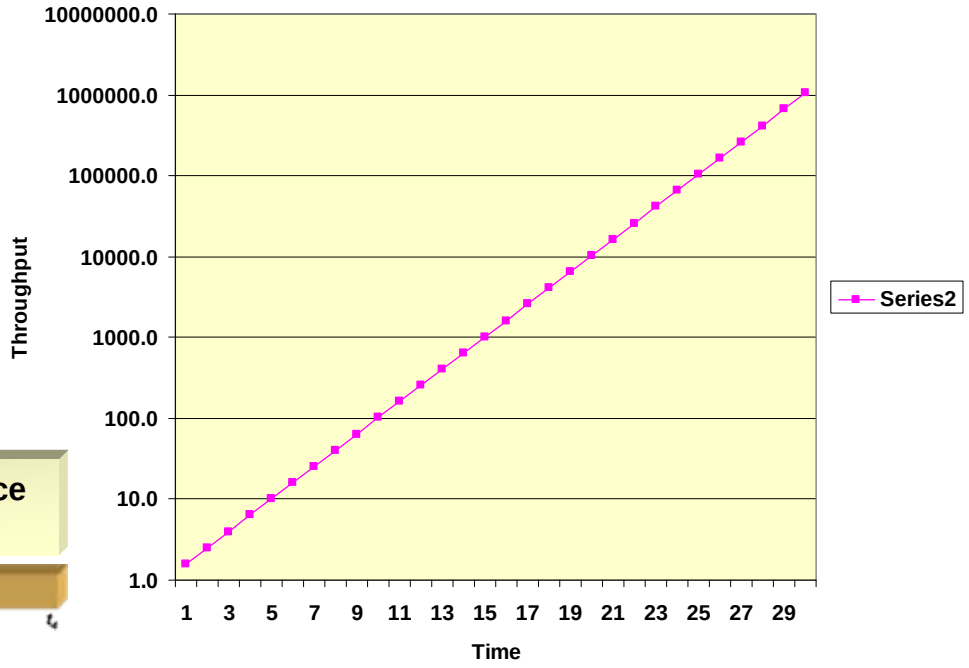
Operational System

FDCE

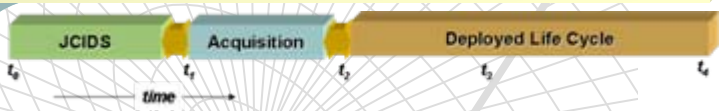
DISA is incorporating a different SOA development and test approach in cooperation with JC2 portfolio (JFCOM)

Commercial Turns vs. DoD Turns





Key – both DSP and GPP processors performance is increasing at ~10x every five to seven years



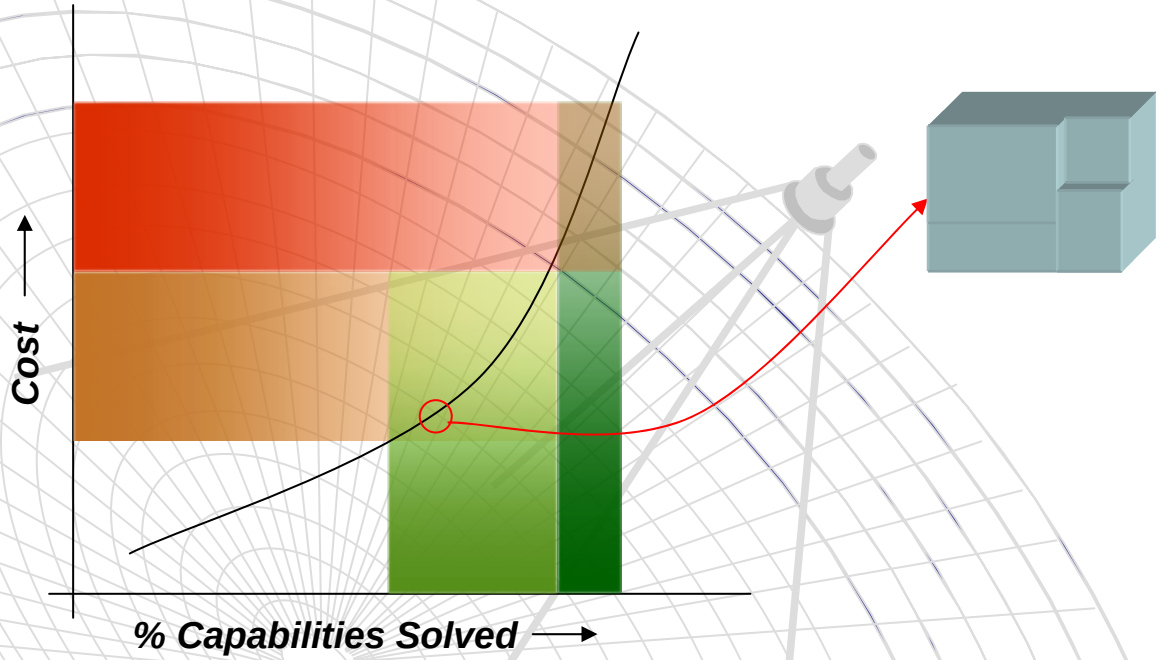
Begin **Acq Start (10x)** **IOC Start (100x)**

DoD Process **DoD Capabilities/Requirements and Acquisition Time**

Commercial Industry 1 2 3 4 5 6 7 8 9 10

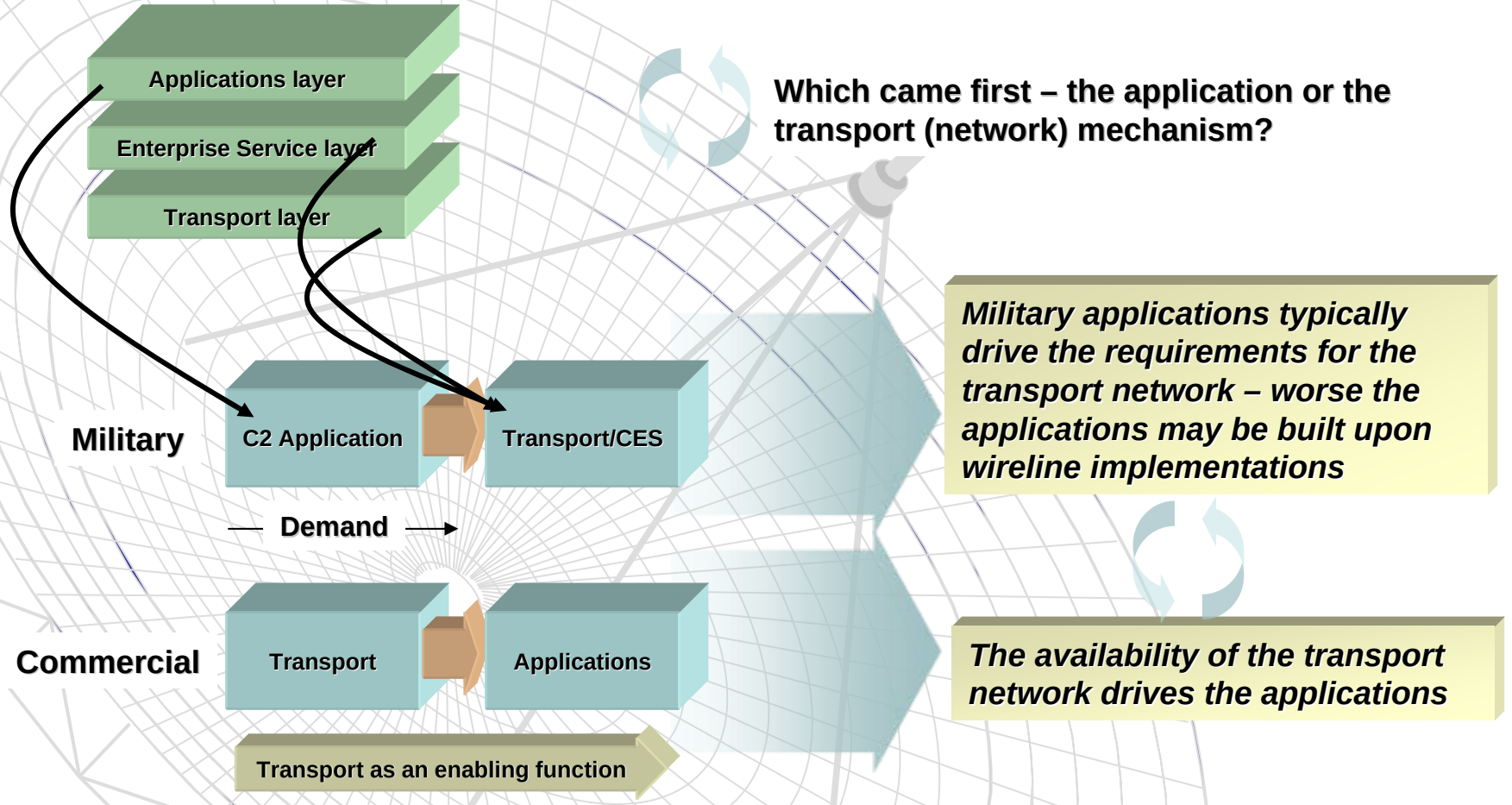
- ***The use of the same process for IT products as for major development platforms forces a development turns time producing products which are already behind the commercial product capabilities***

The Almost Existing Solution Issue



- Cost impact for capabilities – which capabilities
- Not all requirements are the same
- Cyclic assessment / design approach
- Where is the issue – distributed?
- Accuracy of the capability solution vs. cost analysis

Enabling Function Order Difference – Military and Commercial



- Commercial applications are driven by the availability of the network (transport) while military applications are not tied to the network as the enabling entity like the commercial equivalents

Summary

- GIG and Netcentric structures
- Enterprise Services and data strategy (access) is an enabler for future C2 applications
- C2 in the GIG is an application
- Transport is an enabler, but is separate from C2
- C2 is being transformed:
  - Loosely coupled SOA environments
  - Massive information and data access driven by COI and data tagging
  - Unified C2 enterprise approach
  - Enterprise Services and data represent the key solutions for future C2 implementations
  - New development techniques for inclusion of warfighter evaluation and assessments – based on commercial models
- New approaches in IT and GIG components

US Marine Corps
Precision Artillery Systems

Precision Strike Association

Annual Programs Review

25 Apr 07

Marine Corps Operating Concepts for a Changing Security Environment

- Forward Presence, Security Cooperation, and Counterterrorism
- Crises Response
- Forcible Entry
- Prolonged Operations
- Counterinsurgency

- Enabled by Seabasing and Distributed Operations.

Triad of Ground Fires

“Fix Artillery”

“Fix Fires”

High Mobility Artillery Rocket System HIMARS

- Wheeled, indirect fire, rocket system capable of firing current and future MLRS Family of Munitions.
- Bridges the gap between air and surface delivered fires.
- The precision capability of the GMLRS, both unitary and DPICM, validates its employment at both ends of the Warfighting Spectrum.
- Preponderance of GMLRS munitions fired in Iraq have been in support of MNF-W.
- Involved in alternate warhead development, while still maintaining precision requirement.
- 2 Battalions - 1 in Active Component, 1 in Reserve Component
  - Fielding has commenced. FOC expected NLT FY10

Lightweight 155mm Howitzer M777A2

- The M777 Lightweight 155mm towed howitzer replaces the aging M198 155mm towed howitzer which has passed its expected service life.
- Incorporates innovative designs to achieve light weight without sacrificing range, stability, accuracy or durability.
- Retrofitting the M777(A2) with the Digital Fire Control System improves accuracy, responsiveness and enables the employment of precision munitions (Excalibur).
- The ability to fire conventional and precision munitions validates its employment at both ends of the Warfighting Spectrum.
- Fielding commenced ’05. Fielding complete NLT FY10.

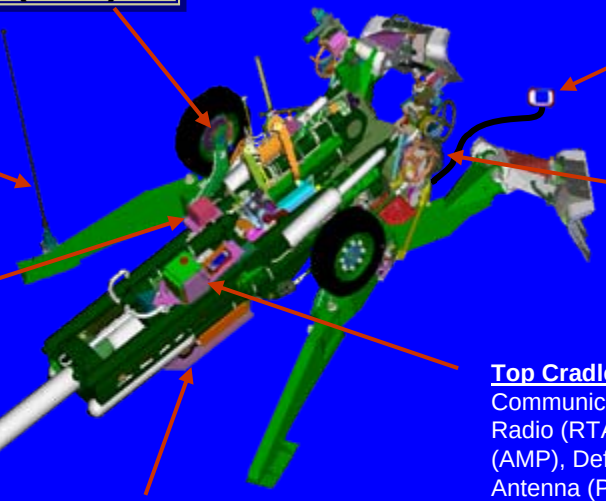
M777A2 Configured DFCS

Asst Gunner's Display (AGD)

Chief of Section Display (CSD)

Vehicle Motion Sensor (VMS)

Radio Antenna (ANT)



Gunner's Display (GND)

Inertial Navigation Unit –
(INU)
Or
(PNS)

Top Cradle Electronics Assembly (TCEA)
Communication-Location Assembly (CLA):
Radio (RTA), Radio Power Supply (RPS), RF Power Amp (AMP), Defense Advance GPS Receiver (DAGR) and Antenna (PLA) in Communications/Location Enclosure (CLE)

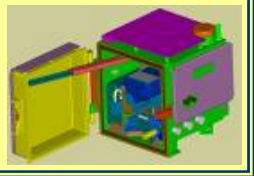
Under Cradle Electronics Assembly (UCEA)
Mission Computer (MSC), Battery (BAT) & Power Conditioning and Control Module (PCCM or PSP)

Batteries

Mission Computer (MSC)

Power Control & Conditioning Unit (PCCM)

CLA
- SINCGARS
- DAGR
- PIK

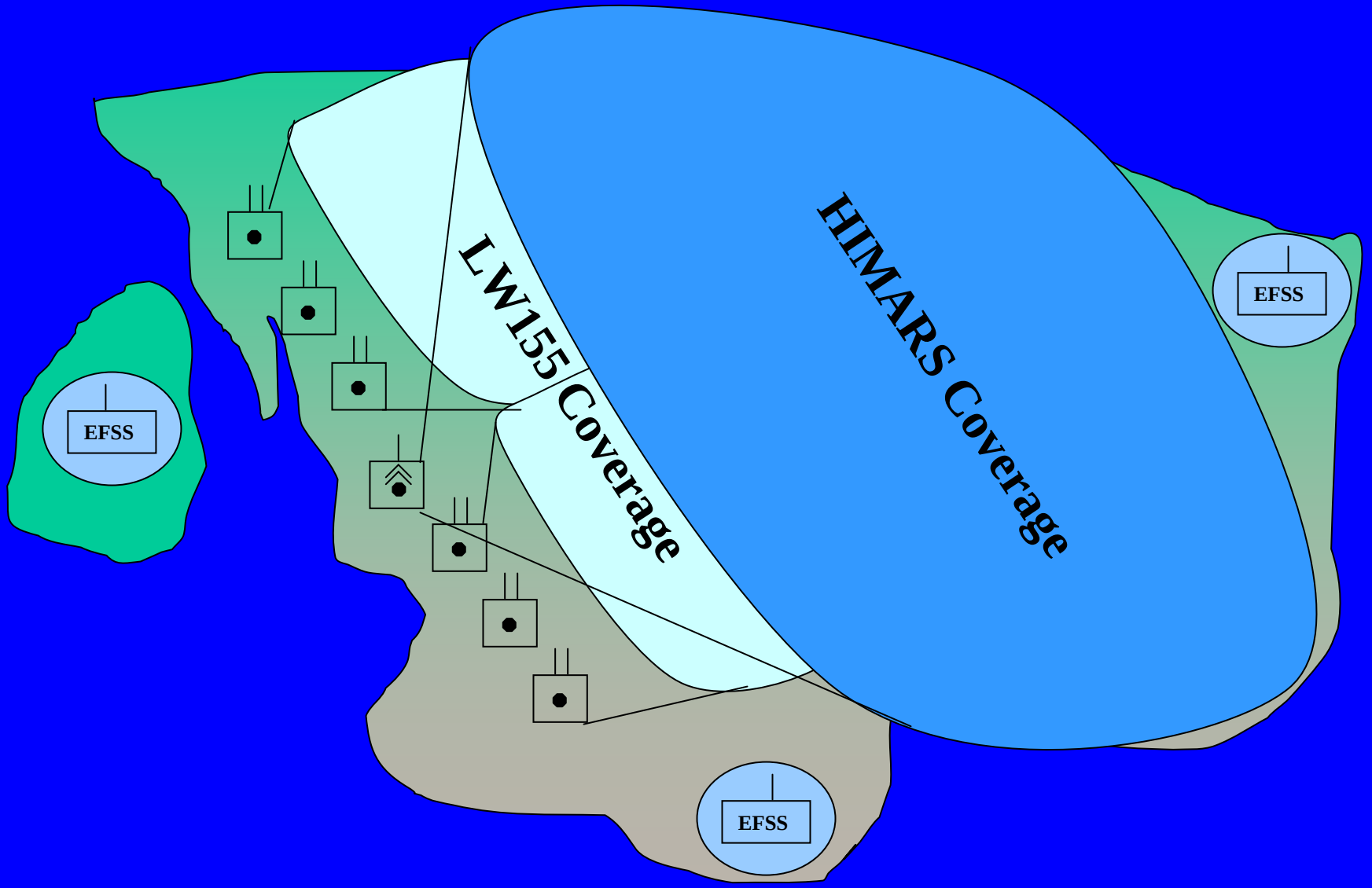


Expeditionary Fire Support System EFSS

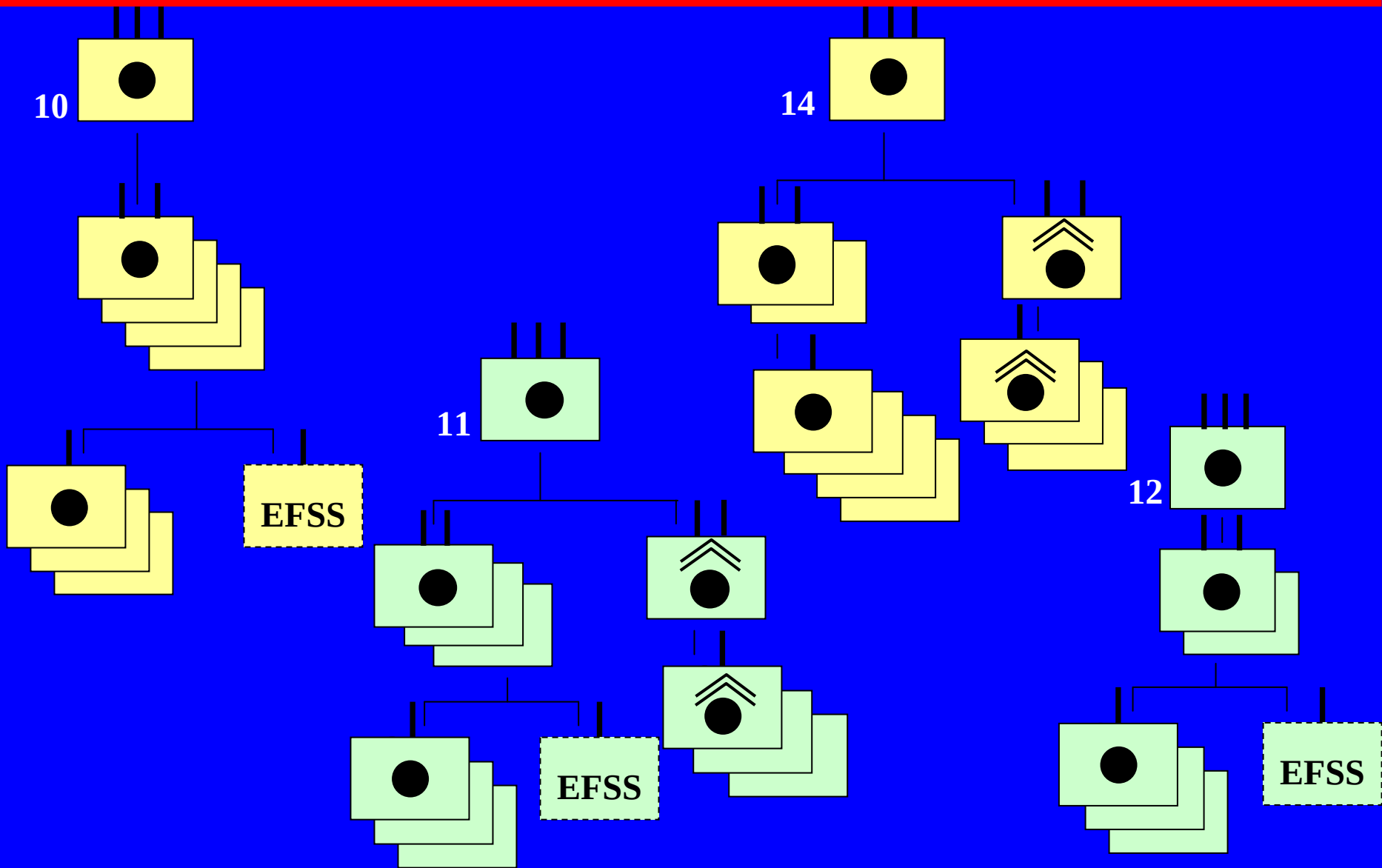
- The direct support weapon system of the vertical assault element of the Ship to Objective Maneuver Force. MV-22 internally transportable.
- 120mm rifled, towed mortar.
- Will fire conventional HE, Smoke and Illum at 7km.
- Additive capability for the artillery battalion.
- Operational testing scheduled for June 07, fielding shortly thereafter. Fielding complete NLT FY11.

- Precision, Extended Range Munition (PERM)
  - In development
  - 8-14KM Range
  - 20M CEP

Triad Coverage Concept



Organic Ground Indirect Fires (2010)



The rest of the story.....

Target Location Error

- Current gap is the sensor for the dismounted Marine. 10mil inherent error in the magnetic compass. TLE of 50m.
- Mitgated through
  - Video down link from UAS/airborne targeting pods.
  - Digital mapping enhancements.
- Future Mitigation
  - JETS / Tier II UAS / GATOR
- Goal
  - < 10m TLE
  - < 15 lbs (total system)

Questions

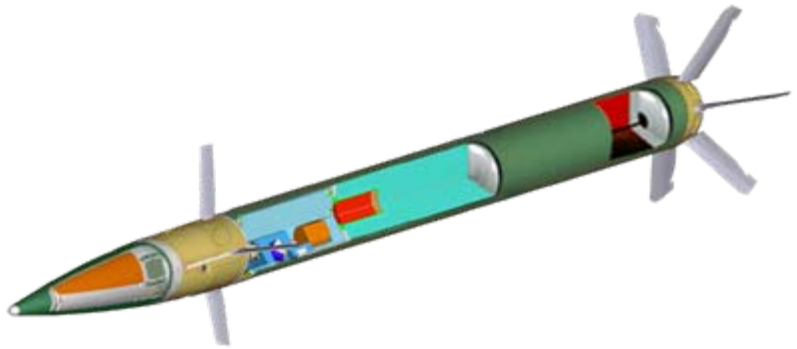
The term “Precision”

LtCol Albert Lagore
Artillery/Rockets CIO
Fires & Maneuver Integration Division
CDD, MCCDC
(703)784-3192
albert.lagore@usmc.mil

Precision Strike Annual Programs Review

Extended Range Munition (ERM)

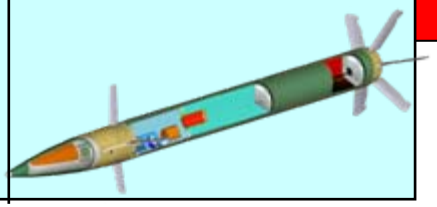
25 April 2007



CDR Kevin LaPointe
Naval Gunnery Project Office IWS3C
202-781-4202
LaPointeKW@navsea.navy.mil

Naval Surface Fire Support (NSFS) Family of Systems

Extended Range Munition (ERM) 5” Guided Projectile

BTERM Demo	ERGM
	

Naval Fires Control System (NFCS)

MK 34 5” Gun Weapon System

MK 160 Fire Control	MK 45 Mod 4 Gun
 Q-70 Gun Console	 USS Winston S. Churchill Trial Bravo © Brian R. Wolff / IIPL

Magazine Handling System

DDG 81 - 112

Conventional Munitions

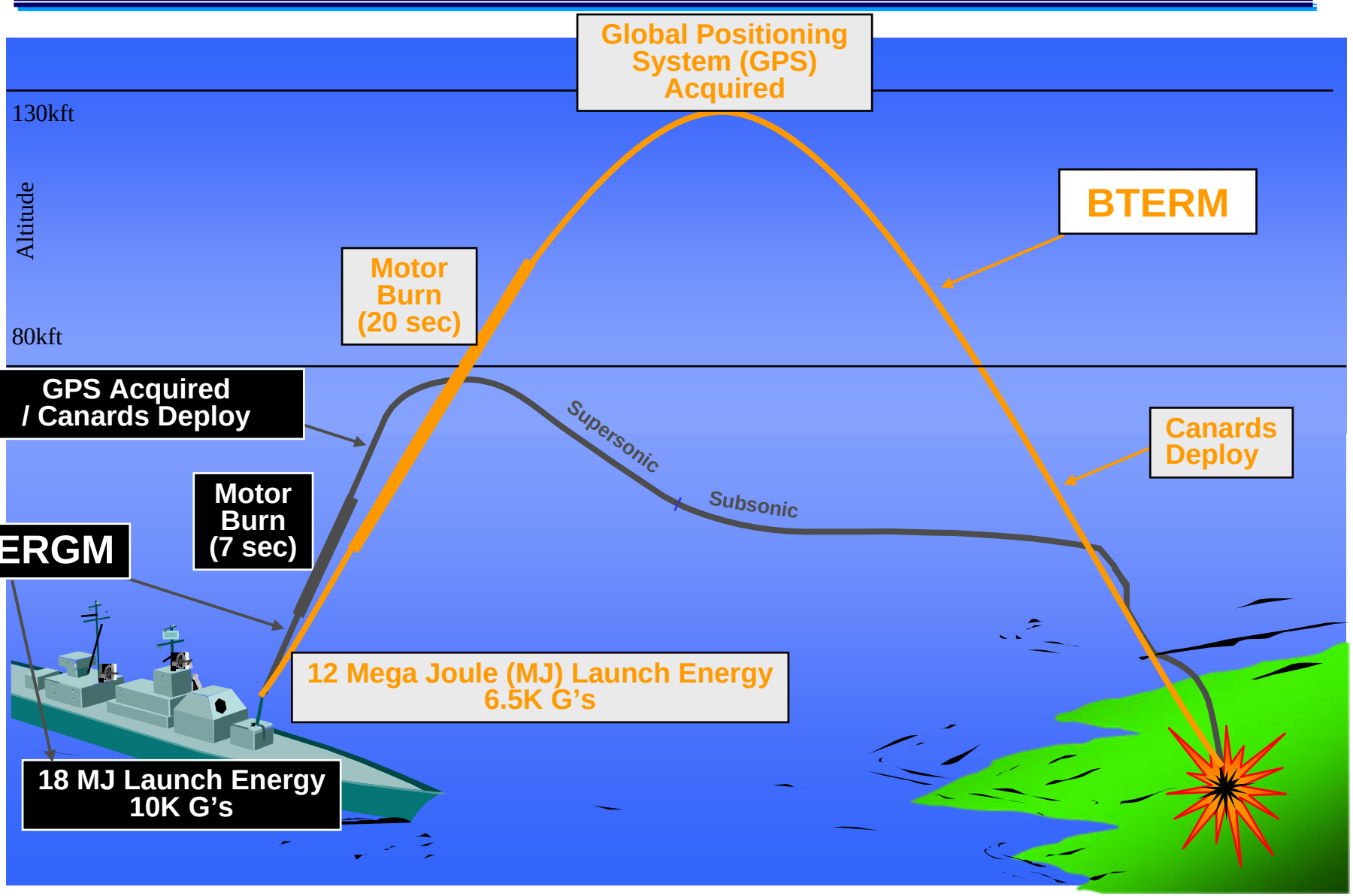
ERM CDD Requirements
(JROC Approved 22 May 06)

Key Performance Parameter (KPP)	Threshold	Objective
Range		
Minimum	15 nmi	10 nmi
Maximum	41 nmi	63 nmi
Time-of-Flight		
41 nm	<5.0 min	<2.5 min
63 nm	<7.5 min	<3.5 min
Accuracy (meters Circular-Error-of-Probability (CEP))		
Unjammed	20 m	5 m
Jammed	20 m	18 m
Rate of Fire (rounds per minute)	5	10
Net Ready KPP (Interoperability)	100% of all Top Level IER's	100% of all IER's
ERGM Demonstrated		

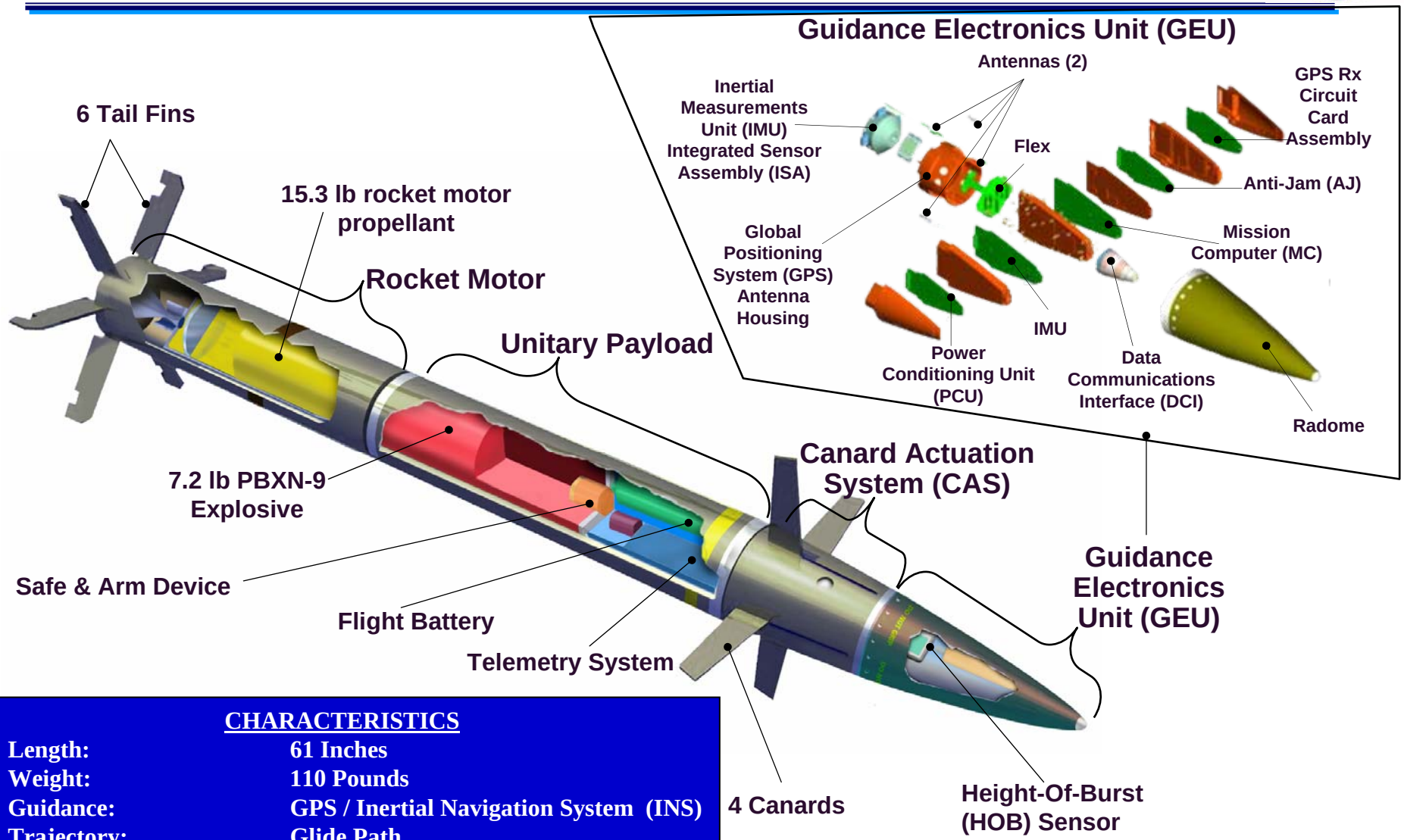
Selected Non-KPP Requirements

- Reliability (90% - Threshold)
- Lethality (4 targets)
  - Truck: Single stationary cargo truck (Zil-157)
  - Personnel: 20 standing personnel, uniformly distributed in open terrain 100m x 100m
  - Radar: Straight Flush
  - Artillery Position w/servicing crew
- Insensitive Munitions
- Affordability
- Climatic Conditions Survivability
- Electromagnetic Effects
- Advanced Fuzing Capabilities / Multi-Round Simultaneous Impact (MRSI) – Desired Capability

ERGM / BTERM Mission Profiles



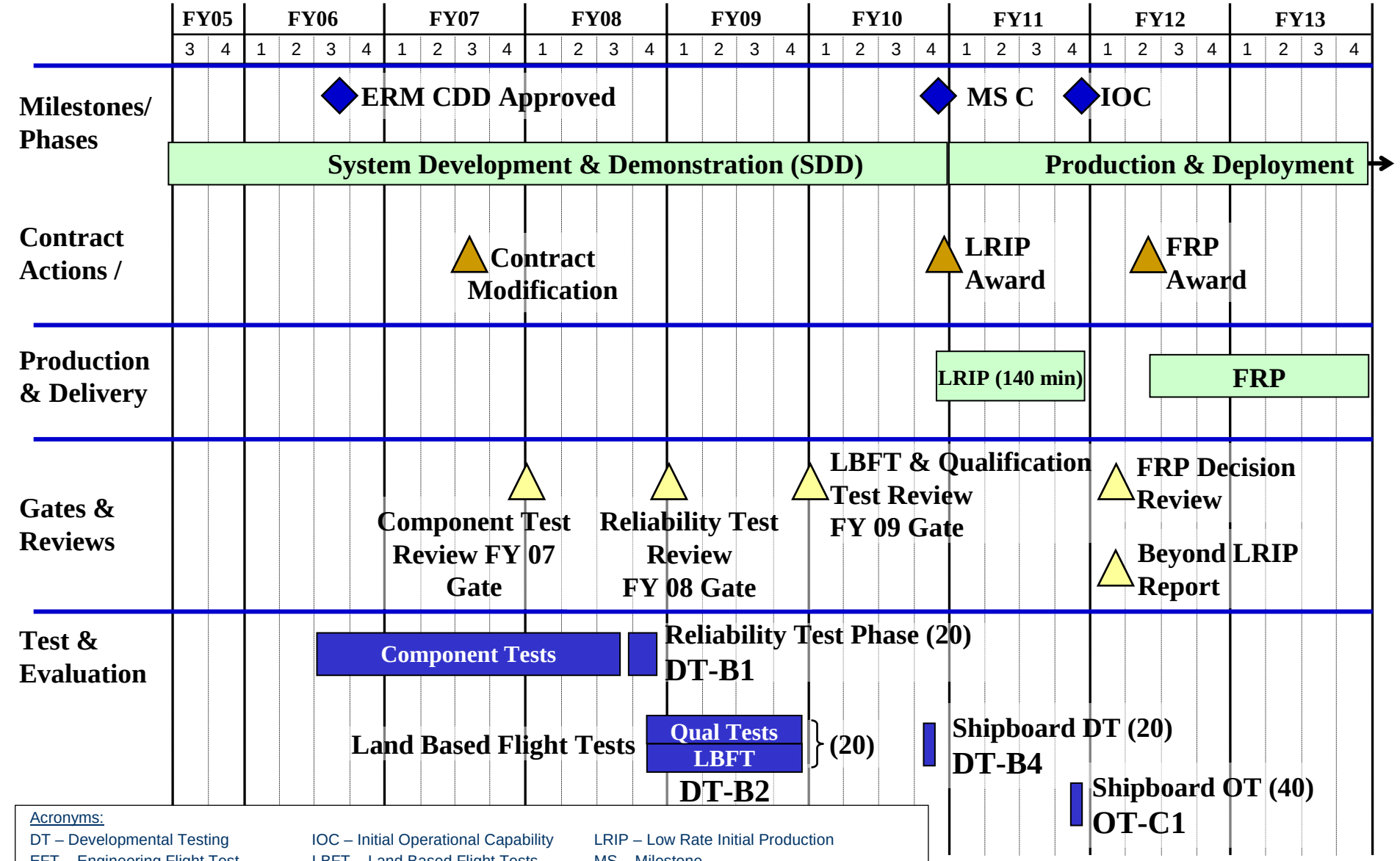
Extended Range Guided Munition (ERGM)



CHARACTERISTICS

- **Length:** 61 Inches
- **Weight:** 110 Pounds
- **Guidance:** GPS / Inertial Navigation System (INS)
- **Trajectory:** Glide Path
- **Payload:** Unitary Warhead w/HOB Fuze
- **Range:** 13 to 48 Nautical Miles
- **Primary Contractor:** Raytheon

ERGM Acquisition Schedule



Acronyms:

DT – Developmental Testing
EFT – Engineering Flight Test
FRP – Full Rate Production
IOC – Initial Operational Capability
LBFT – Land Based Flight Tests
OT – Operational Testing
LRIP – Low Rate Initial Production
MS – Milestone
CDD – Capability Development Document

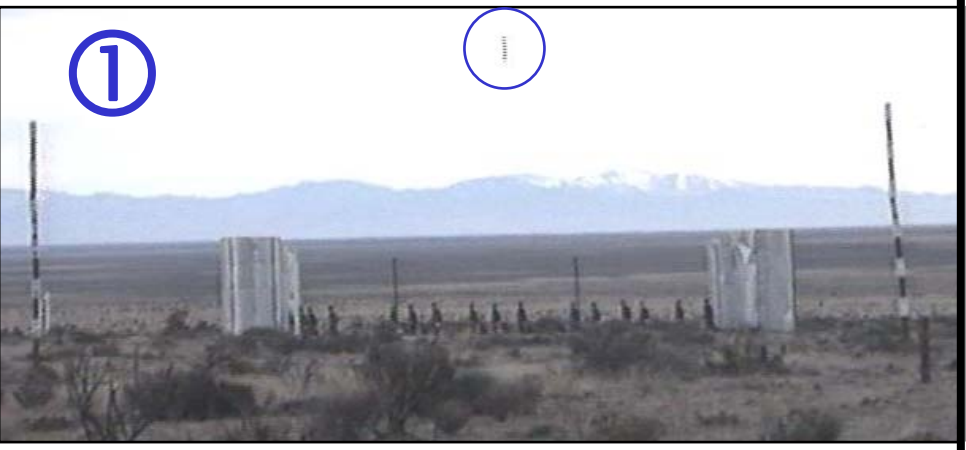
ERGM Major Test Events

Test Phase	Estimated Date	Test Location	Quantity Tested	Remarks
DT-B1	4Q FY08	WSMR	20	◆ Reliability Demonstration ◆ All shot to >41 nmi – Assess Accuracy
DT-B2	FY09	WSMR	20	◆ Evaluate all KPP's ◆ Assess Lethality vs Targets ◆ Environmental Conditioning
DT-B3	4Q FY09	WSMR	5	◆ Gun Weapon System End-to-End Test
DT-B4	4Q FY10	Shipboard San Clemente Island	20	◆ Evaluate Entire System
OT-C1	4Q FY11	Shipboard San Clemente Island	40	◆ Operational Testing

CANCELLED

ERGM Engineering Flight Test A
(Video)

65,600 psi / 10,000g, 41.2 nmi, <4 feet accuracy

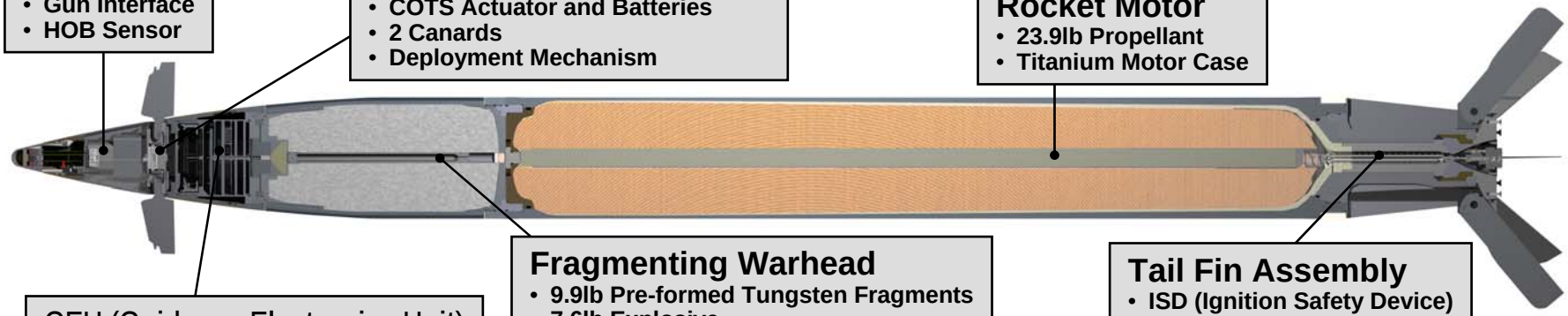


Ballistic Trajectory Extended Range Munition (BTERM) II

Fuze
- Gun Interface
- HOB Sensor

CAS (Control Actuator System)
- COTS Actuator and Batteries
- 2 Canards
- Deployment Mechanism

Rocket Motor
- 23.9lb Propellant
- Titanium Motor Case

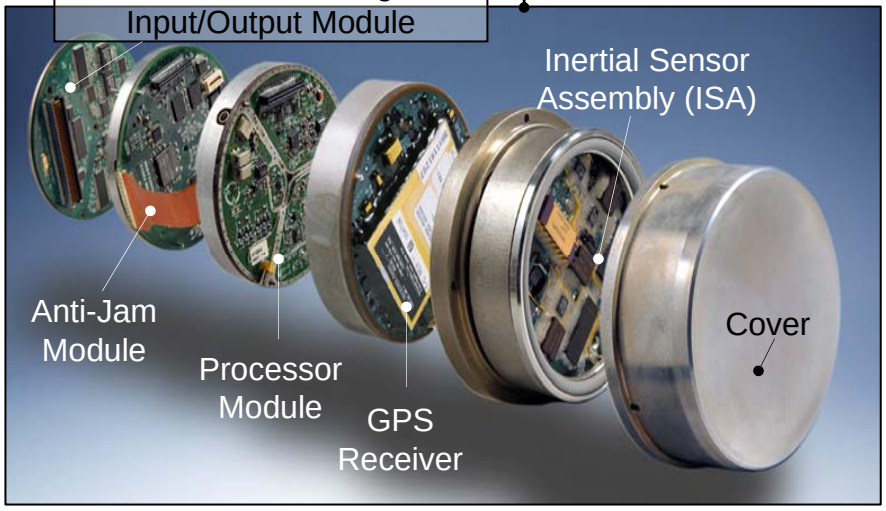


Fragmenting Warhead
- 9.9lb Pre-formed Tungsten Fragments
- 7.6lb Explosive

Tail Fin Assembly
- ISD (Ignition Safety Device)
- 8 Titanium Taper Fins

GEU (Guidance Electronics Unit)

Power Conditioning & Input/Output Module



CHARACTERISTICS

• Length:	61 inches
• Weight:	96 pounds
• Guidance:	GPS/INS
• Trajectory:	Ballistic
• Payload:	Pre-formed fragmenting Unitary Warhead w/HOB Fuze
• Range:	54 nautical miles (Projected)
• Primary Contractor:	Alliant TechSystems (ATK)

ERM Production

- ERM inventory objective is 15,000 rounds (domestic)
  - Baseline design
  - Total may increase
    - Product Improvement Program (PIP) efforts identified
    - Foreign Military Sales – no decisions yet
- Threshold production cost of $58K (FY05 base-year dollars)
  - Includes propelling charge and shipping container
- Initial procurement (LRIP) begins in FY11
- Full rate production begins in FY12
  - For planning purposes, production continues through FY19
  - Approximately 2000 rounds per year

Summary

- **Navy committed to ERM development and fielding**

- **ERGM on track to meet ERM Cost, Schedule and Performance Requirements**
  - **FY08 Reliability Demonstration**
  - **FY11 IOC**

Precision Guided Missiles and Rockets Program Review

Presented to

PRECISION STRIKE ANNUAL PROGRAMS REVIEW

24 April 2007

LTC Mark Pincoski
Product Manager PGM/R
Precision Fires Rocket & Missile Systems (PFRMS)
Phone: (256) 876-5727 (DSN 746)
mark.pincoski@msl.army.mil

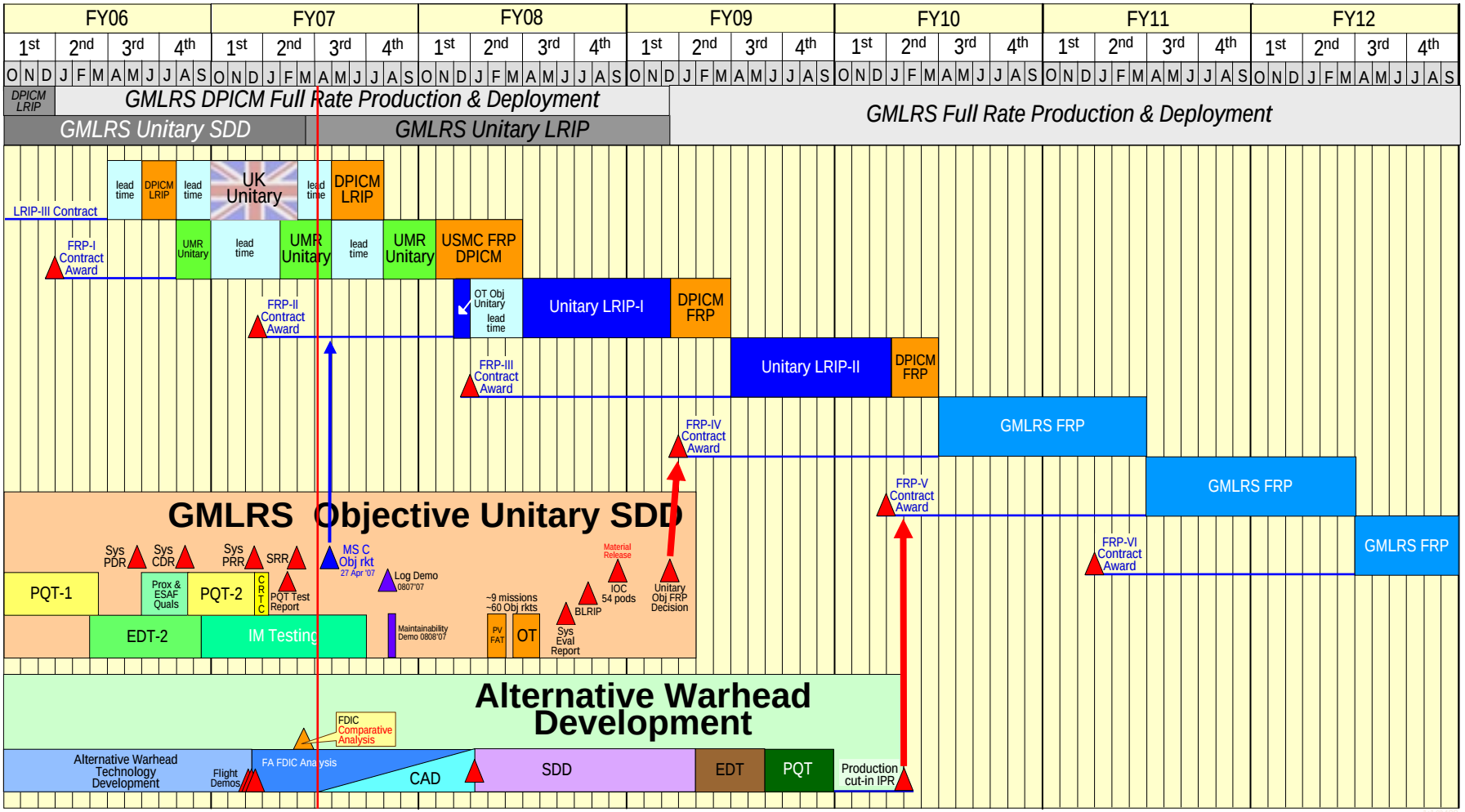
ANY SOLDIER, ANYWHERE, ALL THE TIME

GMLRS Agenda

- GMLRS Program Review
  - Program Schedule/Evolution
  - GMLRS DPICM
  - GMLRS Unitary
  - Alternative Warhead Program
  - Operational Update
- ATACMS Program Review
  - Program Schedule/Evolution
  - ATACMS Unitary
  - Operational Update

Guided MLRS Rockets

GMLRS Program Schedule

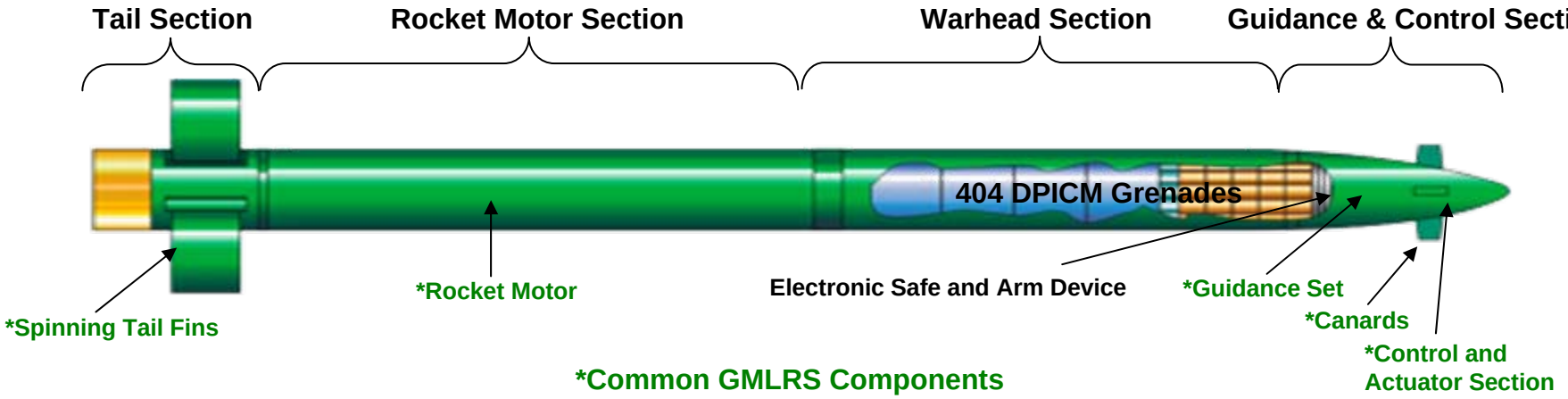


as of 050605Apr07

MLRS / GMLRS History and Evolution

	Basic Rocket (M26)	Extended Range Rocket (M26A1 / A2)	Guided Rocket DPICM (M30)	Guided Unitary Rocket-UMR (XM31)	Guided Unitary Rocket (XM31E1)
User Requirements					
• Range	32 km	45 km	70 km	70 km	70 km
• Precision / Accuracy	Free Flight Rocket	No Load Detent	Inertial Measurement Unit (IMU) / Global Positioning System (GPS) Aided	IMU / GPS Aided	IMU / GPS Aided
• Flexibility	—	Deeper Targets Farther Laterally "General Support (GS)" Mission	Deeper Targets Farther Laterally "GS-Reinforcing" Mission	Deeper Targets Farther Laterally "GS-Reinforcing" Mission	Deeper Targets Farther Laterally "GS-Reinforcing" Mission
• Payload	644 Dual Purpose Improved Conventional Munition (DPICM) M77 Grenades	518 DPICM M77 Grenades	404 DPICM M101 Grenades	Unitary with Dual Mode Fuze	Unitary with Multi-Option (Tri-Mode) Fuze
• Maneuver Safety	5% Dud Rate	4% Dud Rate / < 1% with M101	Threshold: < 2 / 4% Dud Rate Objective: 0% Dud Rate	NA	NA
• Targets	Soft	Soft	Soft	Hard Stationary Point Targets Collateral Damage Sensitive Soft Area Targets	Hard Stationary Point Targets Collateral Damage Sensitive Soft Area Targets
• Survivability	—	Set Back	Set Back Dwell Time	Set Back Dwell Time	Set Back Dwell Time
• Current Inventory	368,848	4,110	1,518	678	0

GMLRS DPICM Overview



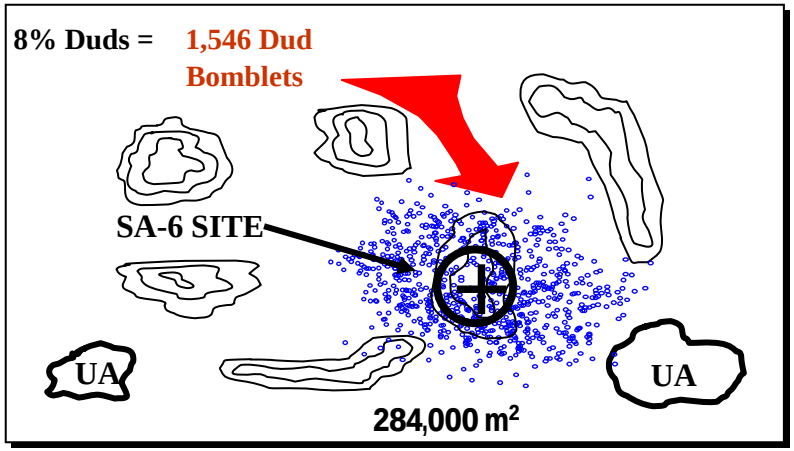
CHARACTERISTICS

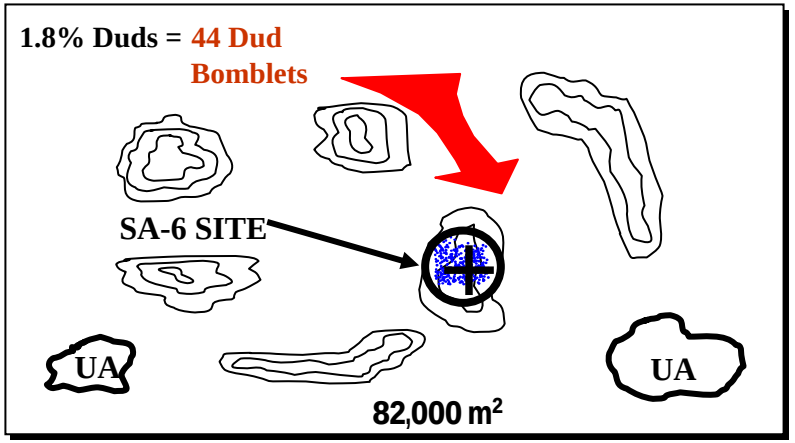
- *Range - 70 Km*
- *Effectiveness - 30% Expected Fractional Damage*
- *Rocket Reliability: Threshold: 92%; Objective 95%*
- *Guidance - Inertial GPS Aided*
- *All Weather; Day/Night*
- *Immediate Response*
- *<2% Hazardous Dud Rate*
- *Launched From M270A1 or HIMARS*

Weight at Launch	668 lbs
Weight at Burnout	401 lbs
CG (X) at Launch	7" 2"
CG (X) at Burnout	5" 11"
Length	12"11"
Diameter	9"

GMLRS DPICM
Increased Effectiveness

- Increase Effectiveness Against Counterstrike and Other Target Sets Through Greater Range and Precision
- Decrease Logistics Throughput Per Target (Reduced Expenditure)
- Mitigate Shelf Life Issue of M26 Stockpiles
- Reduce Unexploded Ordnance





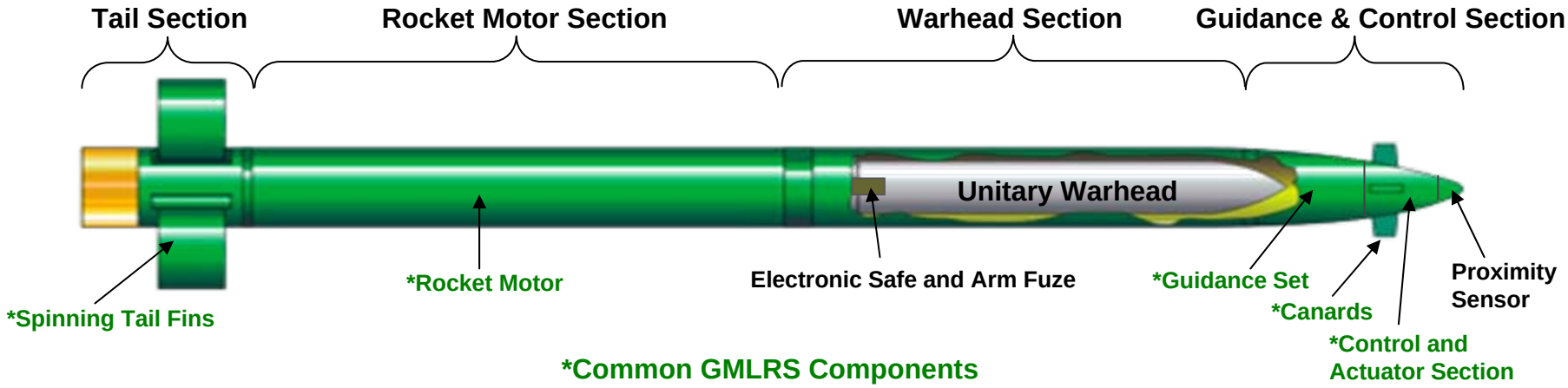
M26	(32km)	75 rockets	6 launchers – 19min, 1 M270A1 Reload = 1 Battery
M30	(60+km)	15 rockets	2 launchers – 2min, No M270A1 Reloads = 1 Platoon (-)

(Data taken from DOTE BLRIP Report 19 May 2005)

72 % Reduction in Hazardous Area

99% Reduction in Duds Per Target

GMLRS Unitary System Overview

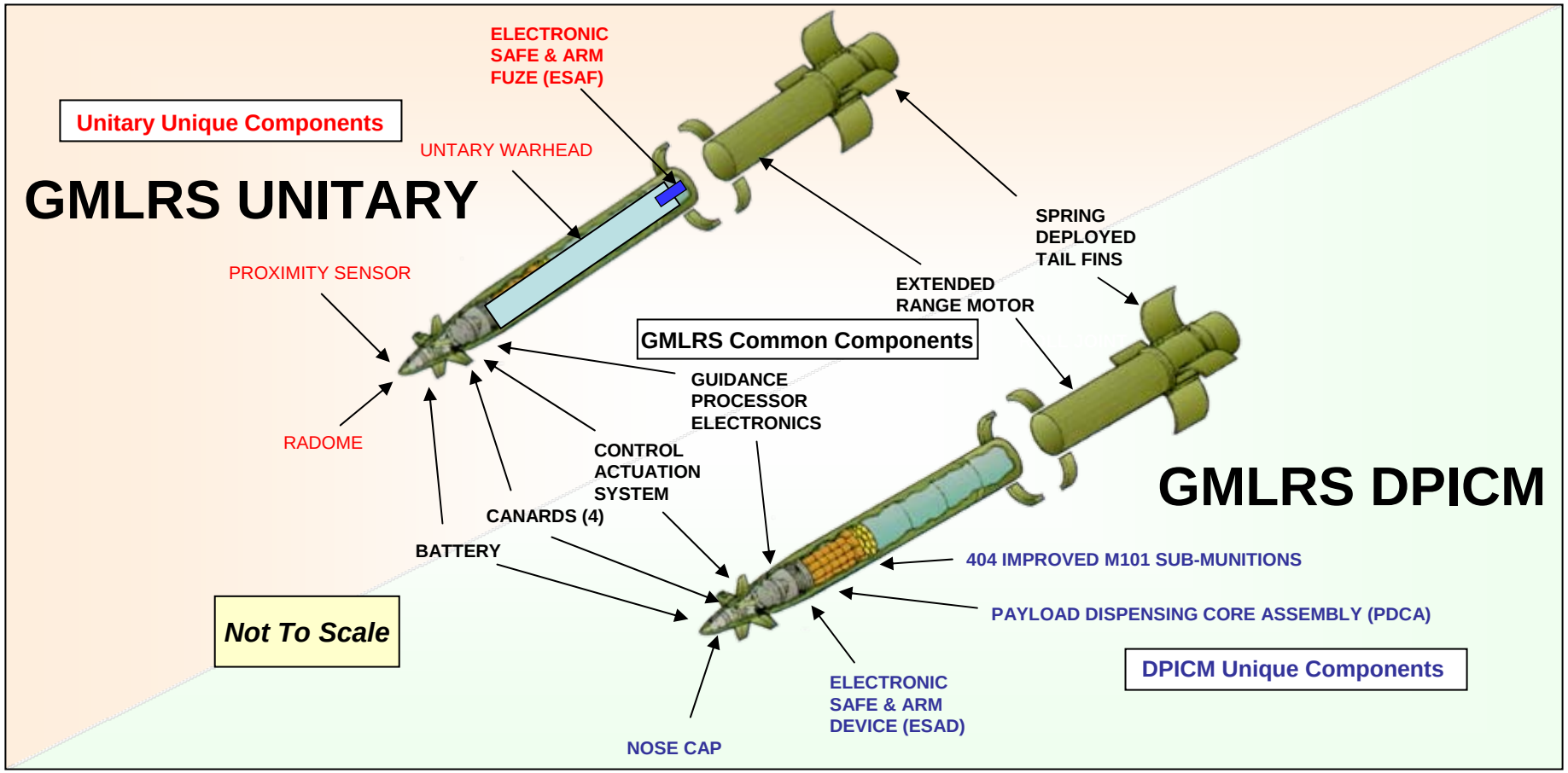


CHARACTERISTICS

- 80% Commonality of Components With GMLRS DPICM
- Additional Commonality With GMLRS Unitary UMR Rocket Currently In Production and Employment
- Launchers - HIMARS or M270A1
- Range - 70 Km
- All Weather; Day/Night
- Accuracy - Less than 5 meters Circular Error Probability (CEP)
- Guidance System (GS) - Contains Inertial Measurement Unit with GPS Updates
- Control Actuation System (CAS) - Commands Canard Steering
- Payload – 200 lb Class Unitary Warhead
- Tri-Mode Fuze: Point Detonate, Delay, Proximity
- Rocket Motor – Arcadene 361 HTPB (260.5 lbs) Propellant With Steel Case
- Spinning Tail Fins / Roll Joint Assembly - Decouples Rocket Roll from the GS
- Electronic Safe and Arm Fuze (ESAF) - Initiates Warhead

Weight at Launch	668 lbs
Weight at Burnout	401 lbs
CG (X) at Launch	7" 2"
CG (X) at Burnout	5" 11"
Length	12"11"
Diameter	9"

GMLRS Commonality



Alternative Warhead
The GMLRS DPICM Problem

The Dual Purpose Improved Conventional Munitions (DPICM) Problem

- *Unexploded Ordnance (UXO)*
- *Insensitive Munitions (IM) Performance*
- *Collateral Damage*

Background

- *GMLRS DPICM meets the ORD lethality requirements*
- *DOD UXO goal is a 99% or higher functioning rate (<1% residual grenades)*
  - *GMLRS DPICM demonstrated 2% UXO at most ranges; 4% UXO at extreme long and short ranges*
  - *With a 1% dud rate, for every DPICM fired (404 grenades), 4 unexploded grenades remaining on the battlefield pose a hazard to friendly troops and non-combatants and are also available for possible enemy conversion into IEDs.*
- *GMLRS DPICM has a Type I IM reaction (Type V is the goal)*
  - *IM compliance is a statutory requirement "where practicable"*
  - *IM waivers from the JROC are required on an annual basis*
- *CENTCOM Rules of Engagement governing the prevention of collateral damage do not allow employment of DPICM rockets in Iraq or Afghanistan*

GMLRS Alternative Warhead Background

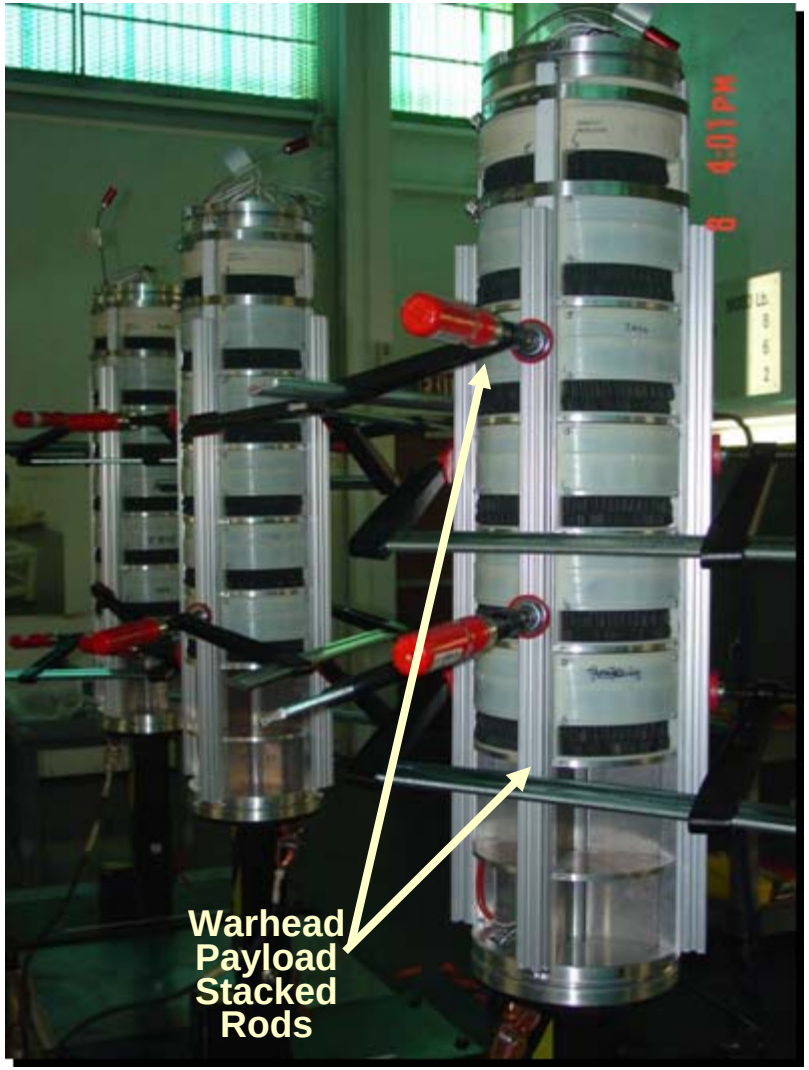
1) The current GMLRS DPICM is not UXO or IM compliant.
   - GMLRS DPICM does meet the UXO Threshold Requirement
   - GMLRS DPICM currently has an IM waiver.
2) AMRDEC completed the KE Rod technology development (the first Alternative warhead candidate) and successfully demonstrated it at WSMR Dec ’06.
3) The USG’s preliminary Business Case Analysis shows the KE Rod as a cost effective material change to the currently fielded DPICM grenade.
4) Ft. Sill is conducting an Alternative Warhead comparative analysis—between the KE Rod and the currently fielded DPICM
   - Alternative Warhead candidates must meet same operational requirements as DPICM

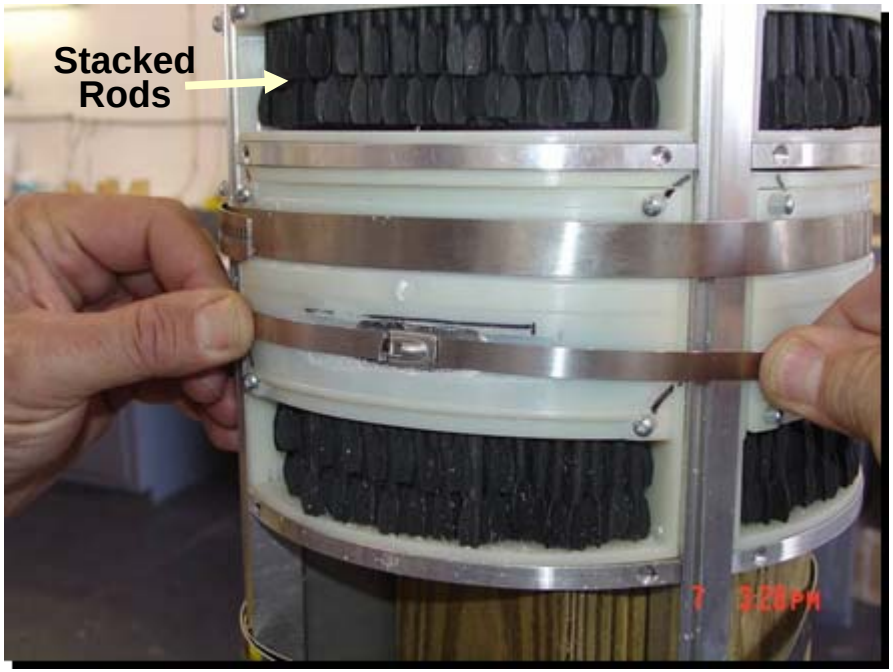
Alternative Warhead Program Description

Provide a cost effective solution to these three requirements:

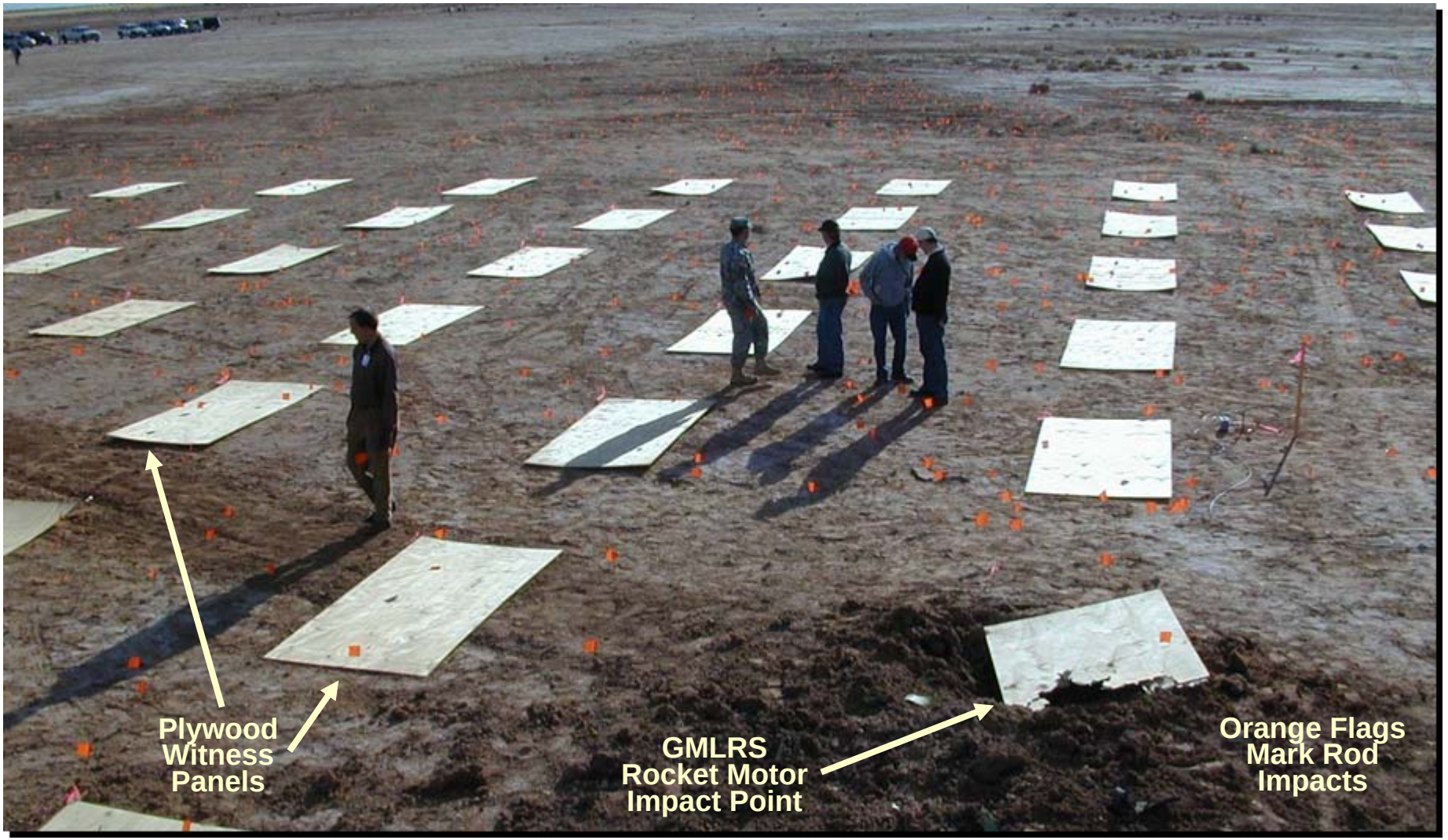
- ***Unexploded Ordnance (UXO):***
  - ***Currently fielded DPICM meets ORD threshold requirement; average dud rate <2% between 20-60km (<4% between 15-20km and 60-70km)***
  - ***Objective ORD requirement for zero duds remaining on the battlefield***
  - ***Some AOs (Korea) accept the threshold capability; others (Middle-East) will not field munitions with less than the objective capability***
- ***Insensitive Munitions (IM):***
  - ***Currently fielded DPICM is classified as a Type I munition; the goal is either Type IV or Type V***
  - ***Implementing the IM fill in the DPICM improves its IM rating to Type III***
  - ***The KE Rod is completely insensitive with a Type V IM rating***
  - ***A Type V Warhead IM rating will not improve the GMLRS system IM rating beyond a Type III rating—the rocket motor is most critical IM component in the GMLRS rocket***
- ***Collateral Damage:***
  - ***Dispense techniques to reduce chances of collateral damage beyond the specified impact zone***

Kinetic Energy Rods
WSMR, Dec '06 Demo





KE Rod Dispersion
WSMR, Dec '06 Demo



GMLRS Operational Update

163 TOTAL ROCKETS FIRED AS OF 4 MARCH 2007

Who uses GMLRS Unitary:

Army	**25**	**15.3%**
Marines	**121**	**74.2%**
Special Operations Forces	**17**	**10.4%**

How GMLRS Unitary is employed:

Troops In Contact	**126**	**77.4%**
Pre-Planned	**37**	**22.6%**

Environments GMLRS-Unitary is employed:

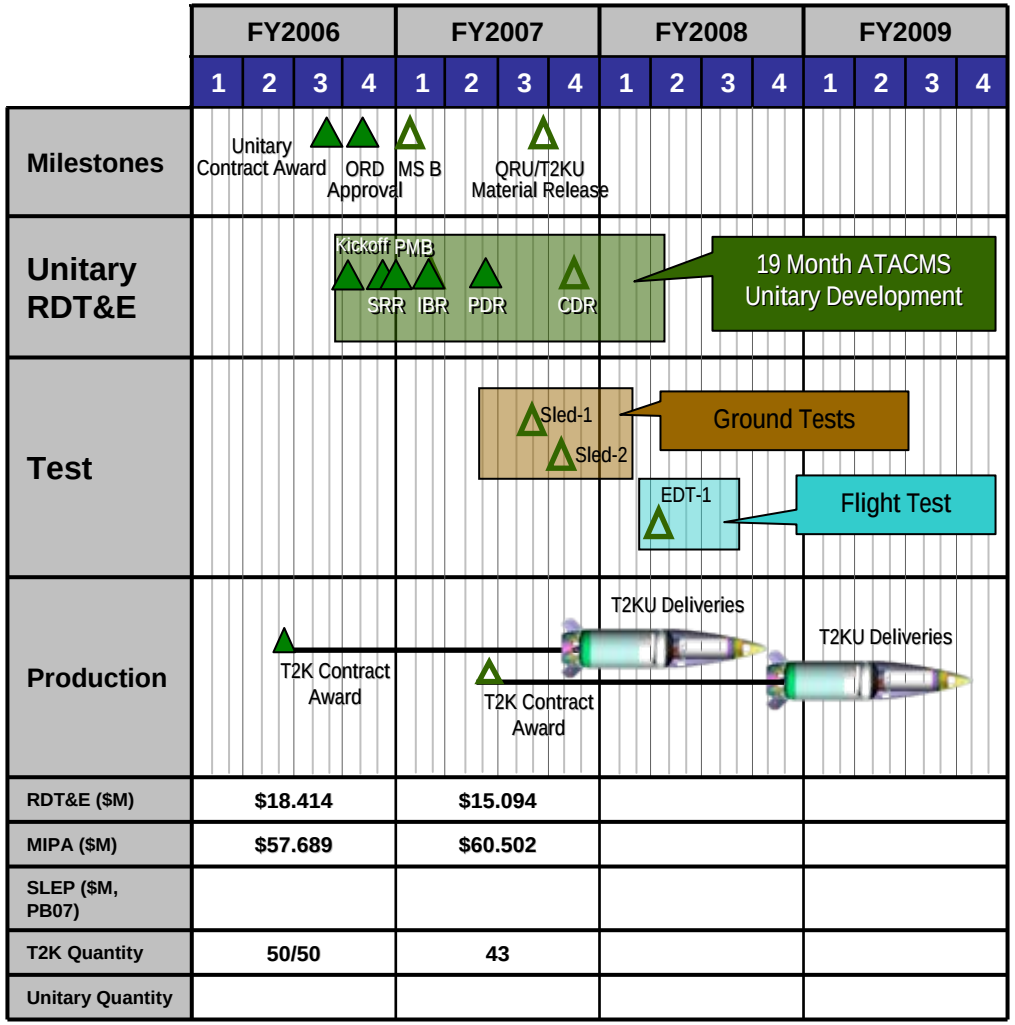
Urban/ Counter Insurgency	**136**	**83.4%**
Other (Training/Test)	**27**	**16.6%**

160 / 163 = 98.15 Reliability

GMLRS Operational Video

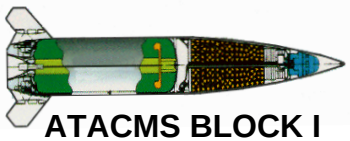
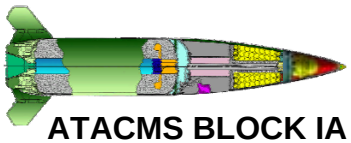
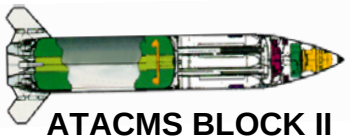
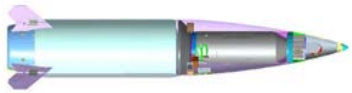
Army Tactical Missile System

ATACMS Program Schedule

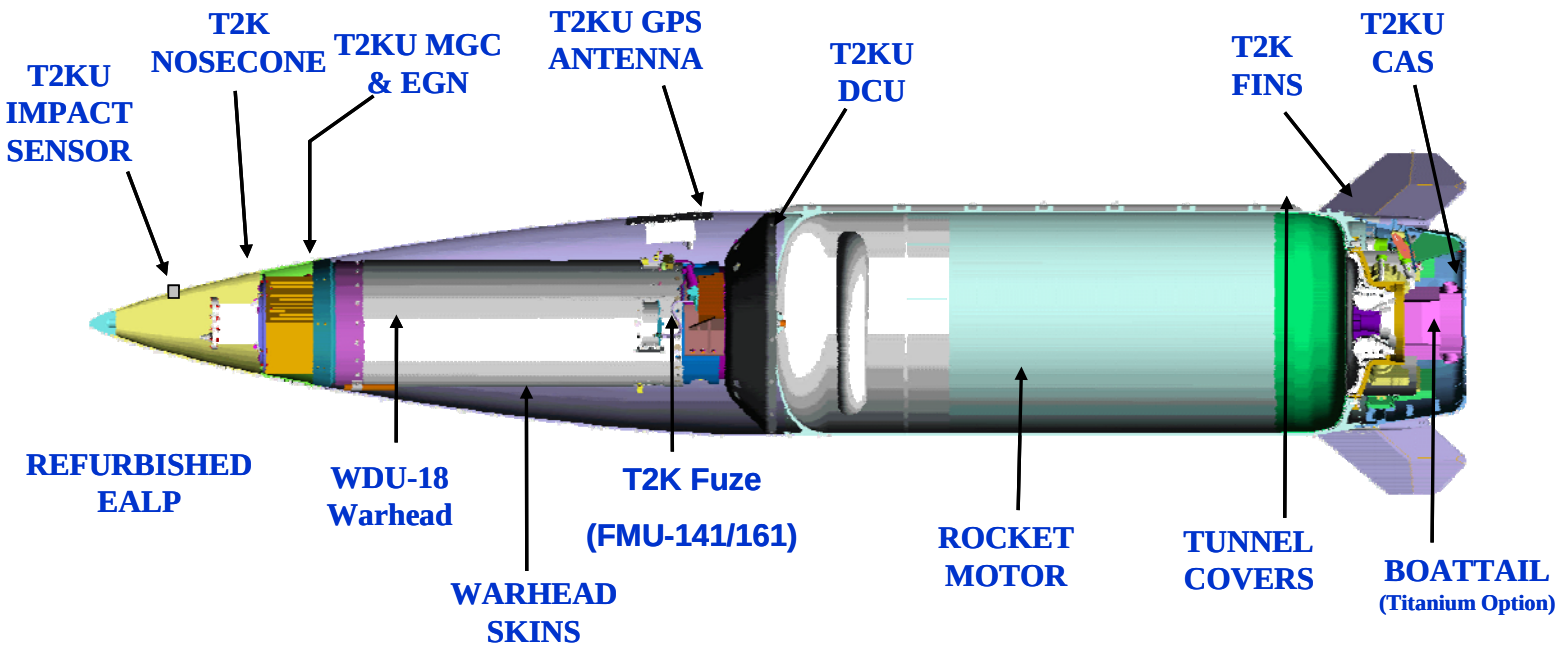


RDT&E ($M)	$18.414	$15.094		
MIPA ($M)	$57.689	$60.502		
SLEP ($M, PB07)				
T2K Quantity	50/50	43		
Unitary Quantity				

ATACMS Family Of Munitions

Variant	Nom.	Navigation	Mission	Munition	Range	Production
 ATACMS BLOCK I	M39	Inertial Guidance (MGS)	Area Weapon System (APAM)	950 M74 Submunitions	Min – 25 km Max – 165 km	FY90-FY96 1076 Units in Inventory
 ATACMS BLOCK IA	M39A1	GPS Aided Inertial Guidance	Area Weapon System (APAM)	300 M74 Submunitions	Min – 70 km Max – 300 km	FY97 – FY03 488 Units in Inventory
 ATACMS BLOCK II	M39A3	GPS Aided Inertial Guidance (MGS II)	Area Weapon System (Weapon Systems)	13 BAT Smart Submunitions	Min – 35 km Max – 145 km	FY02-FY04 75 Units in Inventory
 ATACMS QRU	M48	GPS Aided Inertial Guidance (MGS II)	Precision Point	WDU - 18 Unitary Warhead, FMU-141/B PD Fuse	Min – 70 km Max – 270 km	FY01-FY03 153 Units in Inventory
 ATACMS T2K	M57	GPS Aided Inertial Guidance (T2K)	Precision Point (near vertical engagement)	WDU - 18 Unitary Warhead, FMU-161/B PD Fuse	Min – 70 km Max – 270 km	FY03-FY10 169 Produced 141 at Depot
 ATACMS Unitary		GPS Aided Inertial Guidance (T2K)	Precision Point Air Burst Delay	WDU - 18 Unitary Warhead, FMU-161/B Tri-mode Fuse	Min – 70 km Max – 300 km	

Army TACMS T2K Unitary M-57



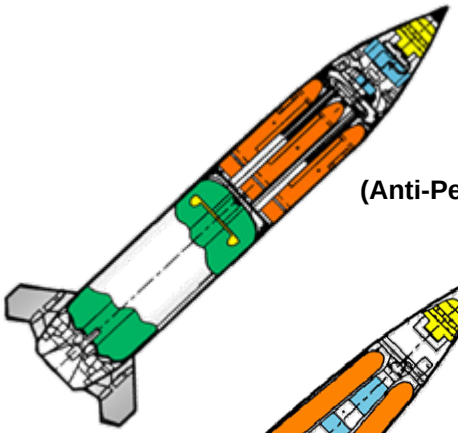
CHARACTERISTICS

- Launchers - HIMARS or M270A1
- Range - 70 Km Minimum / 270 Km Maximum
- All Weather; Day/Night
- Accuracy - Less than 9 meters Circular Error Probability (CEP)
- Guidance System (GS) - Contains Inertial Measurement Unit with GPS Updates
- Control Actuation System (CAS) - Commands Canard Steering
- Payload – 500 lb Class Unitary Warhead
- Tri-Mode Fuze: Point Detonate, Delay, Proximity

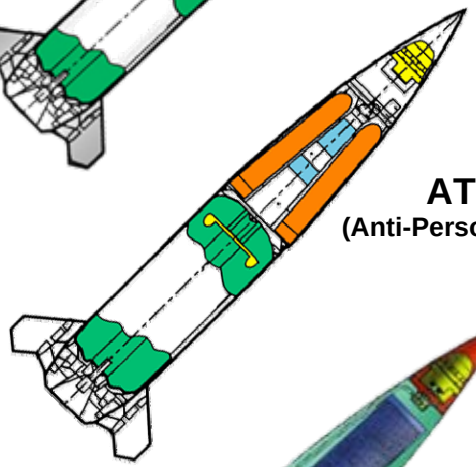
Army Tactical Missile System (ATACMS) in Operation Iraqi Freedom (OIF)

- Fired over 450 ATACMS in support of Operation Iraqi Freedom
- Over 290 ATACMS were fired during the first two days of OIF
- Majority of the missions were Joint Suppression of Enemy Air Defense (SEAD) and Destruction of Enemy Air Defense (DEAD)
- Joint Force with targeting & surveillance Assets
- 3ID fired ATACMS laterally in support of the 1st Marine Expeditionary force (MEF)
- High Mobility Artillery Rocket System (HIMARS) launchers fired 40 ATACMS in close support of small maneuver units in Western Iraq
- ATACMS missiles with Unitary warheads continue to support provide precise, long-range, low collateral damage attack of high payoff targets in support of the Global War on Terror

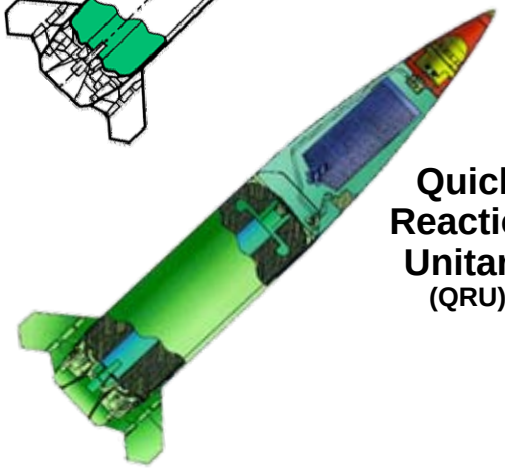
Operation Iraq Freedom ATACMS Expenditures



ATACMS I
(Anti-Personnel/Anti-Materiel)



ATACMS IA
(Anti-Personnel/Anti-Materiel)



Quick Reaction Unitary (QRU)

Quantity Fired

ATACMS I	**371**
ATACMS IA	**69**
QRU	**13**

ATACMS Video

Any Soldier, Anywhere, All The Time

Summary

- GMLRS And ATACMS Provide the Warfighter An Unprecedented Capability That is Proven in Combat
- GMLRS Unitary Continues To be Used In Current Operations
- GMLRS DPICM And Unitary Production Deliveries Ongoing
- GMLRS Unitary To Enter Full Rate Production In 2009

Contact Information

LTC Mark Pincoski
Product Manager - Precision Guided Missiles and Rockets
Precision Fires Rocket & Missile Systems (PFRMS)
SFAE-MSLS-PF
Building 5250
Redstone Arsenal, AL 35898-8000
Phone: (256) 876-5727 (DSN 746)
mark.pincoski@msl.army.mil

Acronyms

AMRDEC – Aviation and Missile Research and Development Center
ATACMS – Army Tactical Missile System
CENTCOM – U.S. Central Command
DOD – Department of Defense
DPICM – Dual Purpose Improved Conventional Munitions
GMLRS – Guided Multiple Launch Rocket System
HIMARS – High Mobility Artillery Rocket System
IED – Improvised Explosive Device
IM – Insensitive Munitions
JROC – Joint Requirements Oversight Council
KE Rod – Kinetic Energy Rod
MIPA – Missile Production Allocation
RDT&E – Research, Development, Test and Evaluation
SLEP – System Life Extension Program
UXO – Unexploded Ordnance

PRECISION STRIKE ASSOCIATION

Precision Strike

Annual Programs Review

"Precision Engagement – Adapting Technology to Meet Warfighter Needs"
24 – 25 April 2007

Arlington, VA

Tuesday 24 April 2007

***JOINT CRITICAL INITIATIVES FOR PRECISION ENGAGEMENT*:** *Mr. Douglas Cassidy*, Joint Integrated Fires Deputy Division Chief (J-8), U.S. Joint Forces Command

PRECISION ATTACK TO ENSURE DOMINANT MANEUVERS:

- **Strategic/Operational Perspective:** *Colonel Bob Cunningham*, USA Chief of Precision Strike Division, Army G-8
- **ATACMS and Guided MLRS:** *Lieutenant Colonel Mark Pincoski*, USA, Program Manager
- **Excalibur:** *Mr. Roger Savage*, Cannon Ammunition Synchronization Officer for Army (G-8)
- **NLOS-LS:** *Colonel Chuck Bush*, Chief of Force Development for FCS, Army G-8
- **Course Correcting Fuzes/Precision Guidance Kit:** *Mr. Russell Hill*, PM, Combat Ammunition Systems, US Army ARDEC, Picatinny Arsenal

RELIABILITY & SUSTAINABILITY OF WEAPONS SYSTEMS: *Dr. Ernest Seglie*, Science Advisor to Director, Operational Test & Evaluation, OSD

Wednesday 25 April 2007

KEYNOTE ADDRESS: ***PORTFOLIO SYSTEMS ACQUISITION ROLE IN THE NEW ACQUISTION & TECHNOLOGY STRUCTURE*:** *Mr. Dave Ahern*, Director, Portfolio Systems Acquisition, OUSD (Acquisition, Technology and Logistics)
JOINT DEEP STRIKE SYSTEMS:

- **Long-Range Strike Update:** *Colonel (S) Gary Mausolf*, USAF, Chief, Air Force Weapon Requirements, AF/A5RW
- **Prompt Global Strike:** *Major Greg Jones*, USAF, Chief, Spacelift Requirements Branch, A5RM
- **USSTRATCOM Organization for Global Strike Execution:** *Lieutenant Colonel Ed Donaldson*, USAF, Deputy Champion, Global Strike CONOPS, AF/A5X

A TECHNICAL PERSPECITIVE OF NETCENTRIC C-2: *Dr. Ronald C. Jost*, Deputy Assistant Secretary of Defense for C3, Space and Spectrum, OASD for Networks and Information Integration
SEA AND LAND STRIKE SYSTEMS: "Ship to Objective Maneuver enabling technology"

- **Strategic/Operational Perspective:** *Captain Ed Barfield*, USN, Deputy Director, Expeditionary Warfare Division (N-85)
- **Navy-DDG 1000/ Long Range Land Attack Projectile & DDG Extended Range Munition:** *Commander Kevin LaPointe*, USN, PEO/IWS 3, NAVSEA
- **Navy-Fire Scout (Vertical Takeoff & Landing Tactical UAV) & Scan Eagle Tier II Capabilities:** *Commander Robert Murphy*, USN Vertical Takeoff and Landing Unmanned Air Vehicle (VTUV), Integrated Product Team Lead
- **Navy-Shared Reconnaissance POD (SHARP):** *Captain Donald Gaddis*, USN, PMA-265
- **Marine Corps- Precision Artillery Systems: Expeditionary Fire Support System & the Towed Artillery Digitization System:** *Lieutenant Colonel Albert Lagore*, USMC, Fire Support Capabilities Integration Officer, Capabilities Development Directorate, Marine Corps Combat Development Command

***ACQUISITION TRANSFORMATION*:** *Ms. Eileen Giglio*, ADUSD for Strategic Plans & Initiatives to the DUSD (Business Transformation), OUSD (Acquisition, Technology and Logistics)

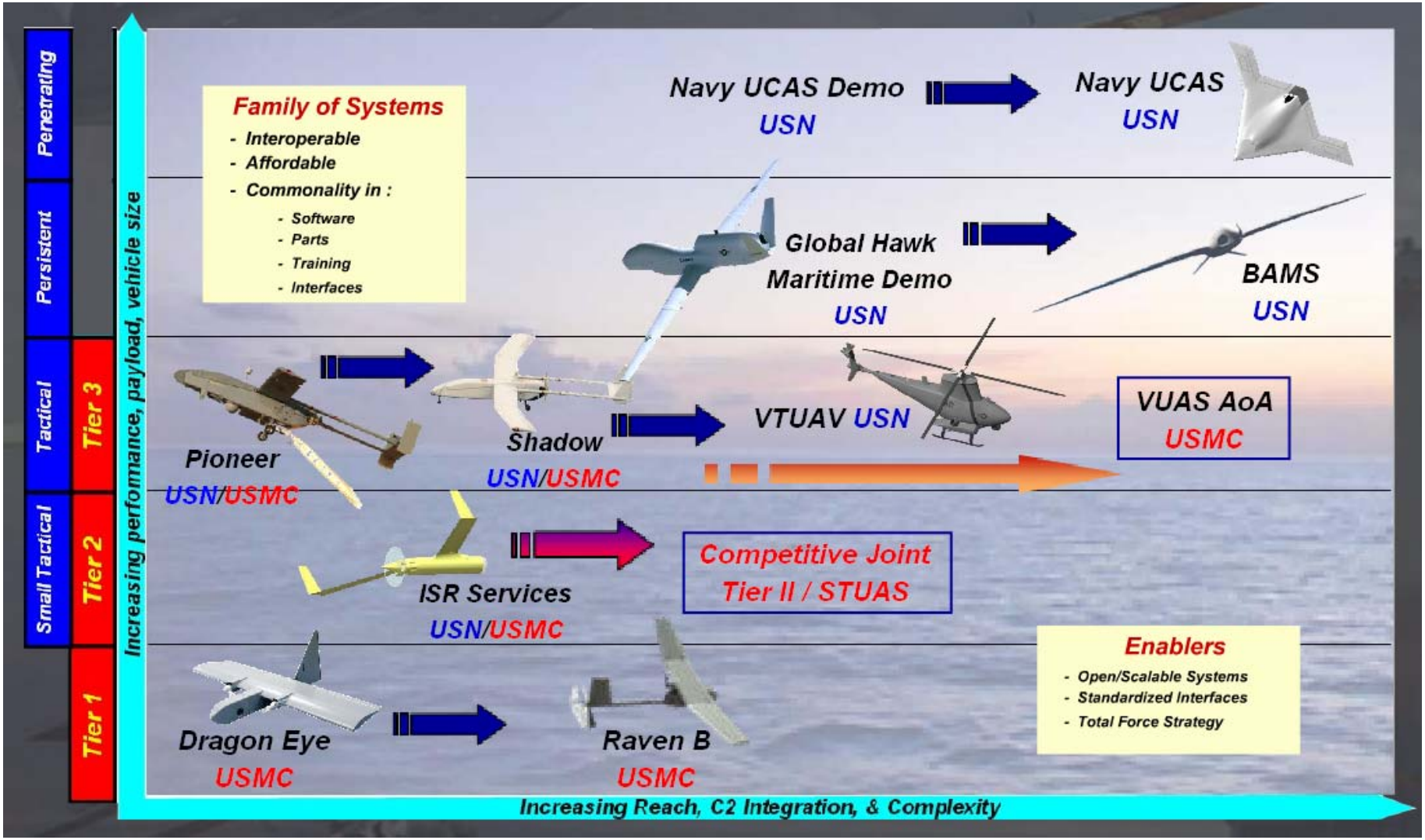
STUAS/Tier II VTUAV Systems

CDR Robert Murphy
PMA-263 VTUAV IPT Lead
301-757-5838
Robert.Murphy@navy.mil

Agenda

- **Family of Systems Overview**
- **STUAS/Tier II**
  - System Description
  - Requirements Overview
  - Acquisition Strategy
- **VTUAV**
  - System Overview
  - System Description
  - Air Vehicle Performance
  - Payload Spiral Integration
  - Initial Weapon Selection Criteria

Naval UAS Family of Systems



System Description

- Small, organic, high duration UAS that operates runway independent for ground and maritime ISR missions. (10 hours+)
- 1 system = 1 ground control station, 3 airframes, 3 payloads and ground support equipment.
- Current payload set = EO/IR, comm relay, selected INT payloads.
- Ground control station integrated with Navy and USMC C2 systems in later spirals.
- Remote terminal included for “disadvantaged user”. Interoperable w/ ROVER III/OSRVT and others in later spirals.

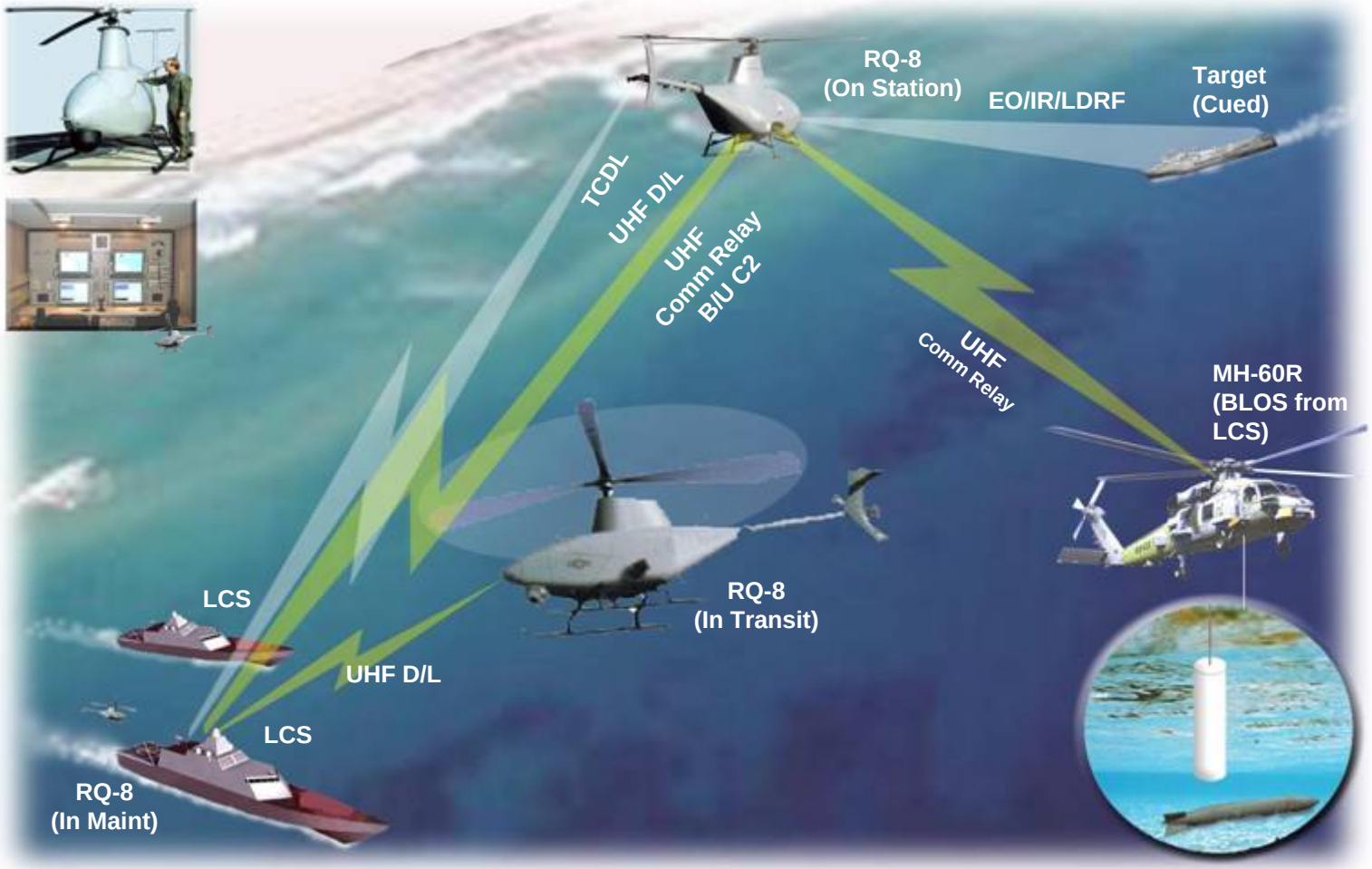
Requirements Overview

- **Proposed IOC FY 10**
- **ICD Approved Jan 2007; includes SOCOM, USAF, USMC, and USN Requirements**
- **AoA underway; estimated completion Aug 2007. USMC will maintain lead, PEO(W) & NAVAIR 4.10 will participate.**
- **CDD will establish capability requirements, including any needed incremental/spiral approach.**
  - Potential need for min development, OTS/NDI acquisition strategy to meet initial IOC requirement.
  - CDD planned completion Nov/Dec 2007.
- **Follow on system capabilities to be defined per spiral/incremental acquisition approach. Definition of follow-on spirals**
  - Increment 0 – off-the-shelf.
  - Increment 1 – C2 integration, comm relay, heavy fuel engine.
  - Increment 2 – payload enhancement.

Acquisition Approach

- **Combined single acquisition program for USN and USMC requirement**
- **N86: USN resource sponsor, Command Element: USMC resource sponsor**
- **ACAT III Program**
  - PEO(W) is the MDA.
- **PMA 263 – Program Lead**
  - MarCorSysCom personnel assisting with MAGTF C2 integration.
- **Full and Open competition for Baseline System for minimum development OTS/NDI system. Grow capability at planned increments after initial fielding.**
- **MS B targeted for FY 08**
- **IOC – FY 10**
  - Desire to phase out current USMC and USN ISR services contracts.

VTUAV System Overview



VTUAV System Description

Fully Autonomous Air Vehicle

- Fully Digital, Dual Redundant Control System
- Based on Schweizer 333 Commercial Helicopter

Brite Star II EO/IR Laser Designation/ Range Finder Payload

- Collect imagery
- Relative range and LOS to target for precision target coordinates
- Laser designate target on command

VTUAV System Description
Ancillary Equipment

Fully Encrypted, Digital Data Links

Tactical Common Data Link

- **Tactical Common Data Link (TCDL)**
  - Air Vehicle Command and Control
  - Imagery and data downlink
- **3 ARC-210 UHF/VHF Radios integrated on Air Vehicle provide control and Communications Relay Capability**

Designed for both Land and Sea Based Operations

UCARS-V2 for Ship Launch/Recovery

NATO-standard Pressure Refueling (JP-5, 8)

Harpoon and Grid Ship Deck Restraint

Interoperable Ground Control Station with Tactical Control System (TCS) software integrated

- **GCCS-M, JDISS, AFATDS, CCTV & JSIPS-N**
- **NATO STANAG 4586 Compliant**
- **Multi-Vehicle control**
- **Open Architecture**

MQ-8B Air Vehicle Performance

- **Service Ceiling – 20,000’**
- **Airspeed - >80 knots**
  - Currently 107 knots
- **Combat Radius – 110nm with 5 hour loiter**
- **All Weather Day/Night capable**
  - Certified lighting system
  - Ambient air temperatures ranging from –29C to +50C
  - Operate in precipitation measuring 1.5 inch per hour for one hour
  - Capable of detecting and transiting through light icing conditions
  - Protected from and resistant to degrading effects of sand, dust and salt laden air
- **Electromagnetic Environmental Effects Qualified**
  - MIL-STD-464A and Guidelines in MIL-HDBK-273C
  - Shipboard and land based environments

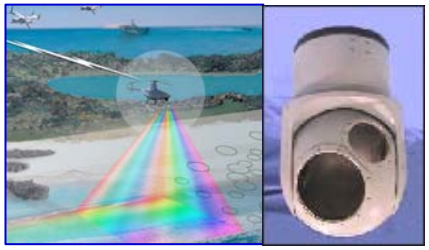
VTUAV Payload Spiral Integration

Current FY-07/08

BRITE Star II

EO/IR/LDRF

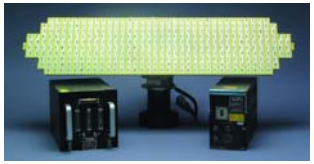
COBRA



Coastal Battlefield Reconnaissance and Analysis Block I, II & III

Block I

RADAR



Maritime Multi-Mode Radar

AIS

Ship Based IFF

Weapons

Precision Weapons

JTF WARNET

Data Relay

Future

CVLWT

Compact Very Light Weight Torpedo

Specialty Payloads

- Chem/Bio/Nuclear Detect
- Homeland Security
- EW/SIGINT

Modular Payload Architecture

- Swap Payloads between missions (Load & Go)
- System recognizes payload and automatically loads software module
- Easily accommodate new payloads via defined interface specifications and open architecture
- Minor control changes to HW/SW on Air Vehicle and GCS for new payloads

Initial Weapons Selection Criteria

- **Weapon Weight < 250lbs**
  - Weight of weapon is a tradeoff with usable fuel which equates to range/time on station
  - Low cost/sufficiently lethal weapons typically lightweight
- **Precision Guidance or Projectiles**
- **Warhead applicable to Fast Attack Craft threat**
- **In Production or Final Stage Development**
- **Qualitative assessment between the types of weapons to select the "best" candidate for integration.**
  - Integration Complexity (launcher, software control, Operator/Mission Control)
  - Stable Flight Dynamics of Air Vehicle
  - Standoff Range/Off-axis Shot / Fire Scout Survivability
  - Shipboard Considerations (build-up, storage, certification)

Questions?

Project Manager Combat Ammunition Systems (PM CAS)
XM1156 Precision Guidance Kit (PGK)
Program Overview
24 April 07

Presented by: Mr. Russell Hill (OPM CAS)
Email: russell.d.hill@us.army.mil
Picatinny Arsenal, NJ
Telephone: 973-724-2236

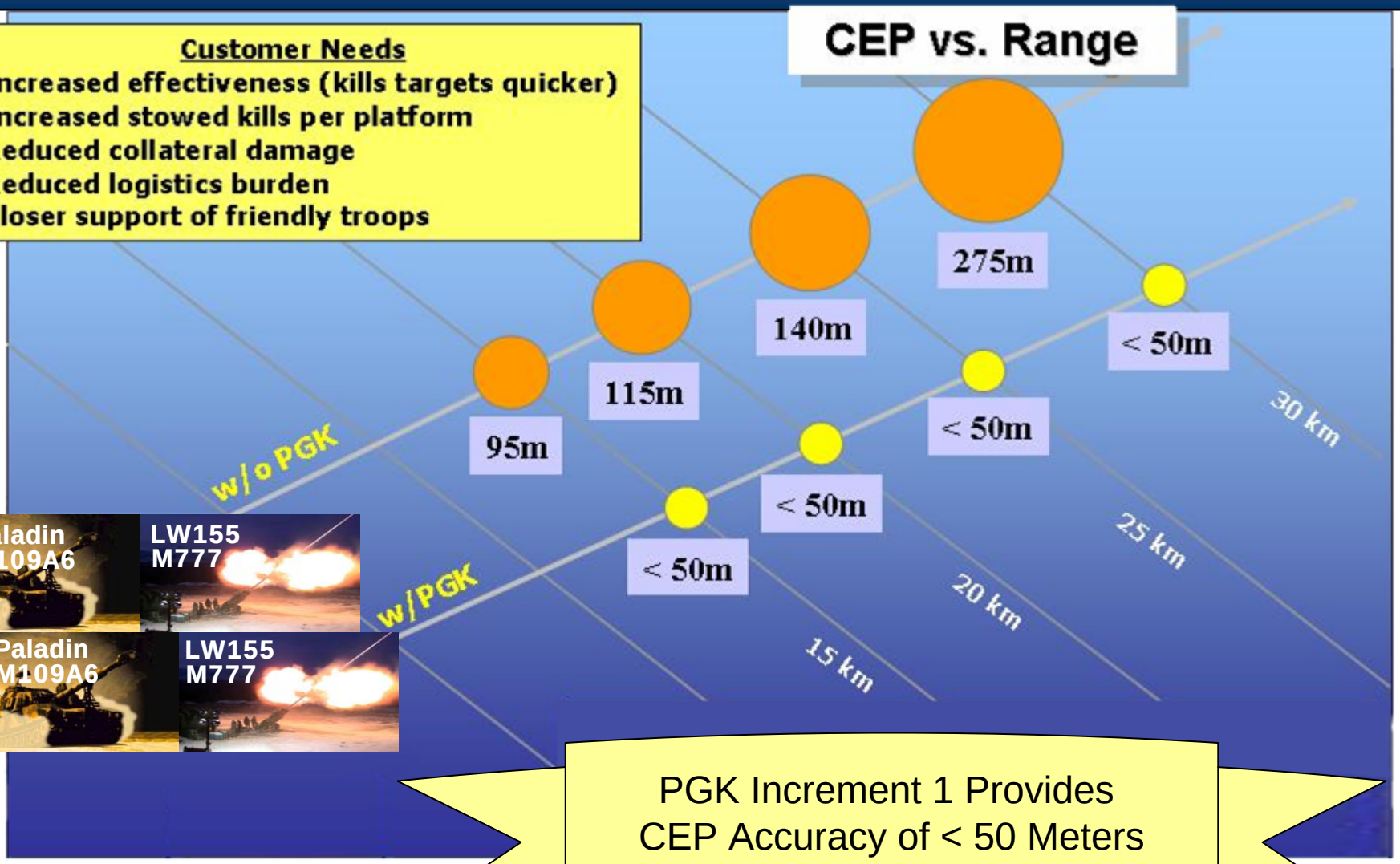
Overview

- PGK is a low cost, fuze-sized module that is intended to replace a "NATO standard" fuze on existing stockpiled artillery ammunition
- PGK corrects the ballistic trajectory of spin stabilized ammunition resulting in a small terminal miss distance and thus improves projectile accuracy
- PGK provides *"First Round Effects"*
- PGK technology can be applied to literally millions of existing 155mm and 105mm projectiles

155mm Projectile Accuracy

Customer Needs

- Increased effectiveness (kills targets quicker)
- Increased stowed kills per platform
- Reduced collateral damage
- Reduced logistics burden
- Closer support of friendly troops



PGK Increment 1 Provides
CEP Accuracy of < 50 Meters

105mm Projectile Accuracy

w/ PGK

50m

50m

50m

w/o PGK

60m CEP

97m CEP

163m CEP

5 km

10 km

15 km

20 km

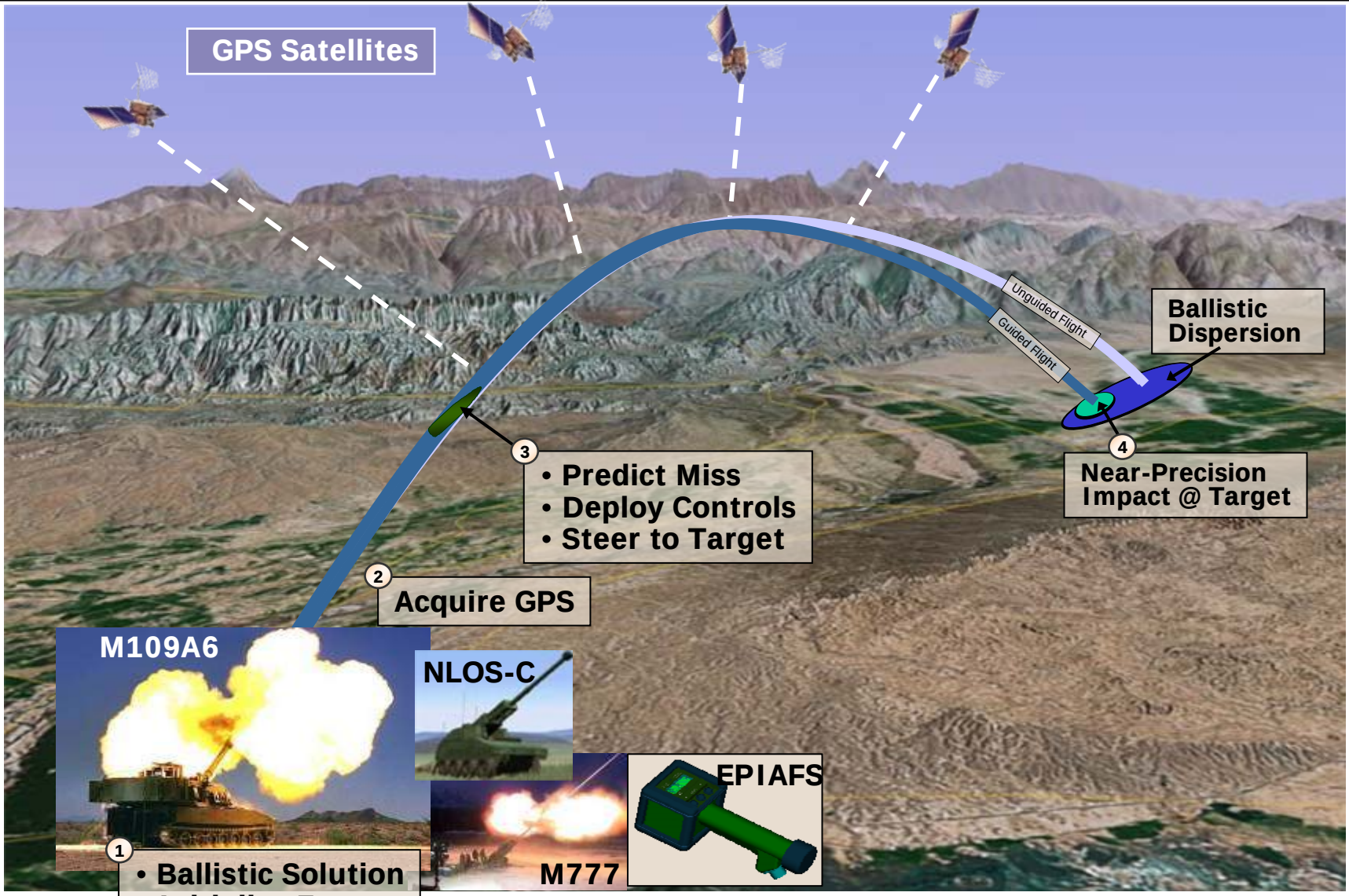
PGK CEP

M913 CEP HERA

Aim Point

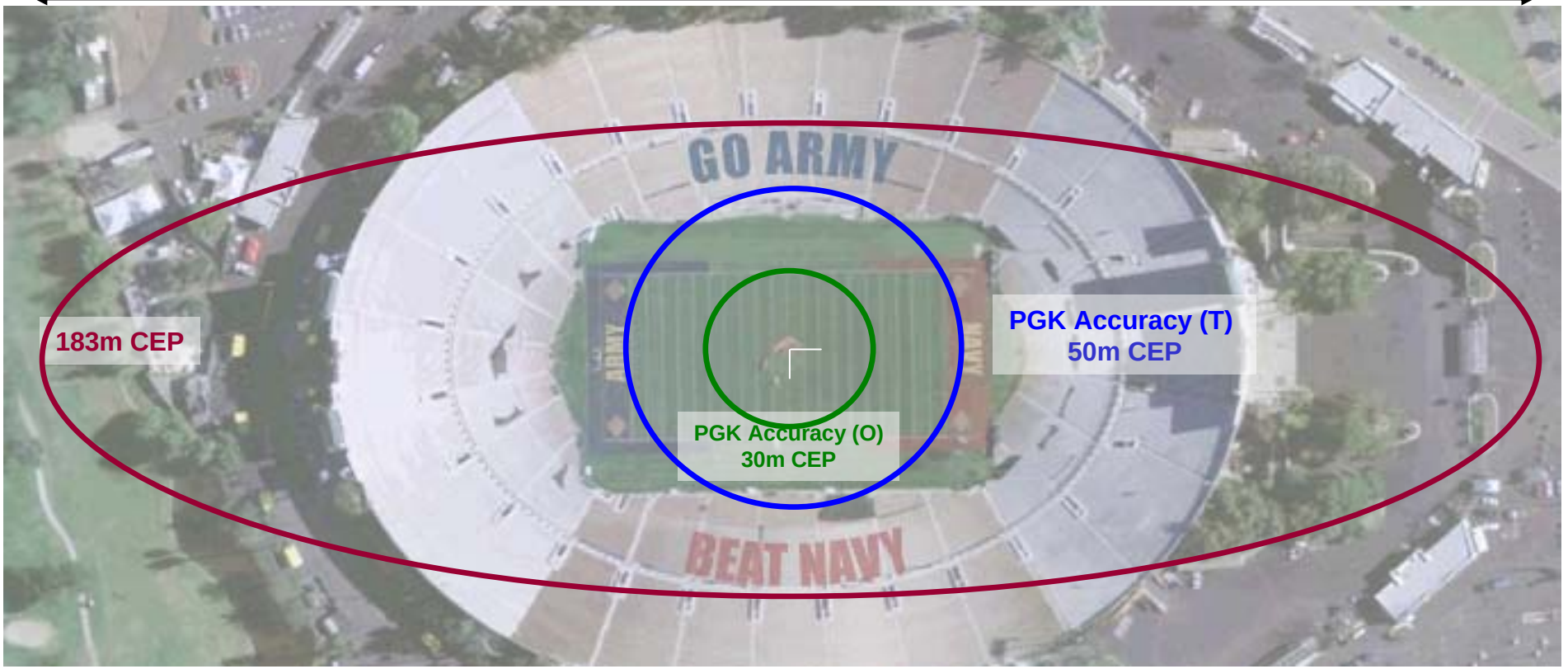
Circular Error Probable (CEP) - the radius of a circle within which 50% of the projectiles fired will impact.

Operational Overview



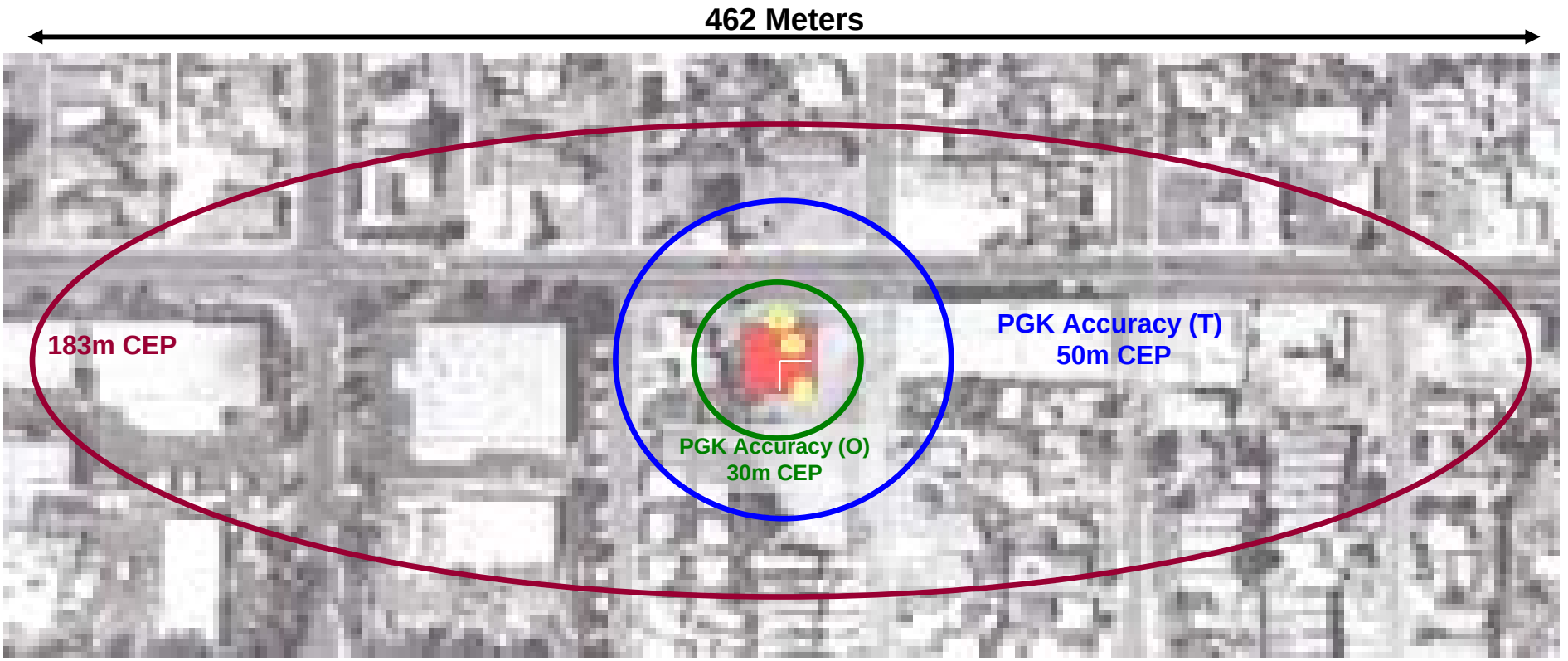
CEP Comparison - Guided vs. Unguided

462 Meters



The Rose Bowl, Pasadena, CA

Guided vs. Unguided Collateral Damage Reduction



Typical City Block Depiction

Acquisition Strategy

- MS A approved on 20 December 2005
- Acquisition Strategy/Acquisition Plan approved by MDA
  - ✓ Awarded 2 TD contracts on 30 June 06
    - Conduct TD demonstration April 2007
    - Expect to Award option for Increment 1 SDD in May 2007 – (18 months)
    - Contains options for Increment 1 Production (3 years)
- Future development contracts for Increment 2 & 3 will be competitively awarded
- SDD contract award on schedule for May 2007

XM1156 PGK Performance Spec Summary

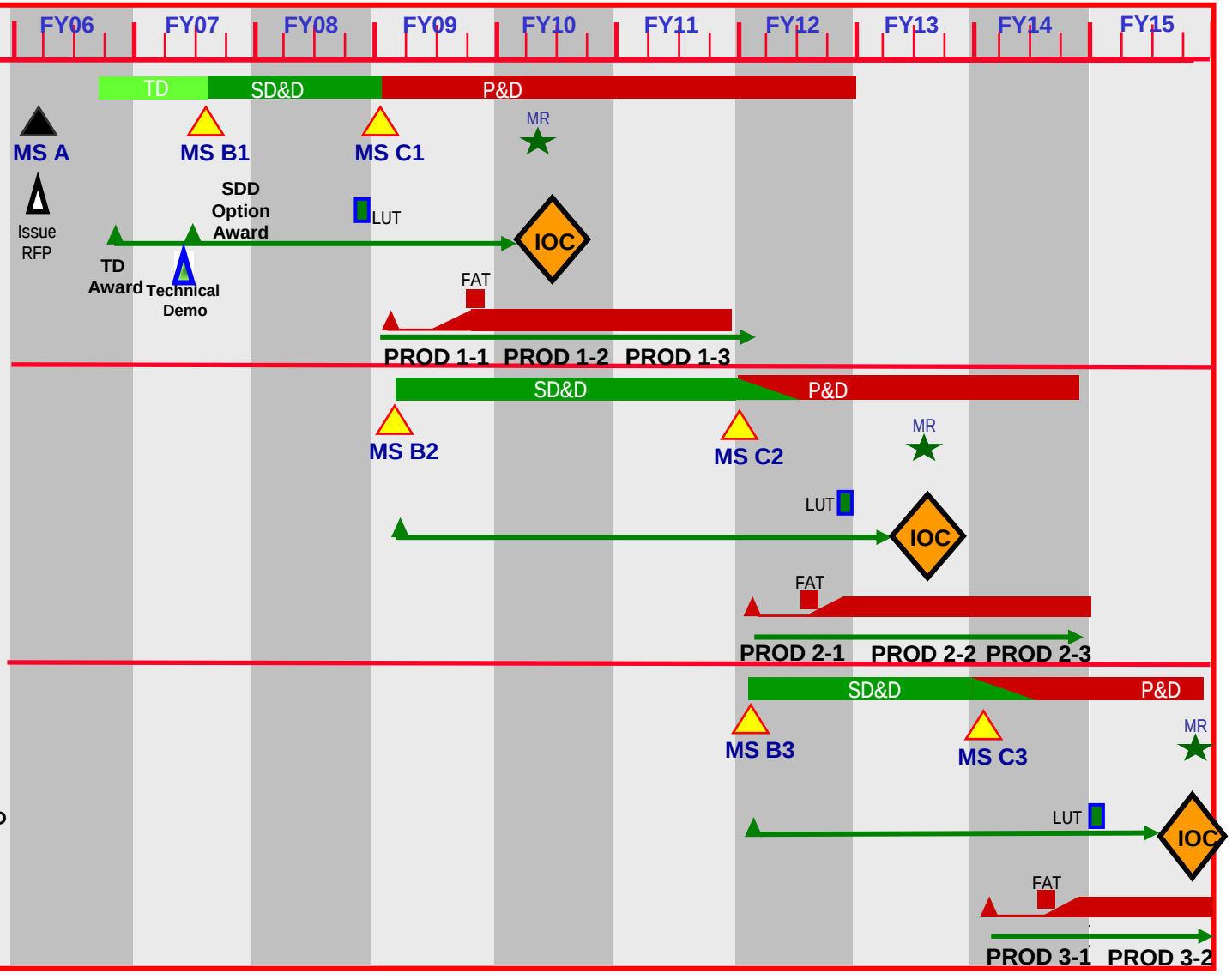
	TD	Increment 1 XM1156	Increment 2 TBD	Increment 3 TBD
Accuracy w/ ½ Hr MET	**50m CEP**	50m CEP	30m CEP	30m (T) 10m (O) CEP
Reliability		92%(T), 97%(O)	→	→
Platform/ Max Charge	Paladin 4 MACS	M777, Paladin / M119A1, M203A1, 5 MACS	→	NLOS C, M119 / M200
Compatibility		MIL-STD-333 Deep Intrusion	MIL-STD-333 →	→
Munition type	M549A1	M107, M549/A1, M795 ***155mm HE***	→ ***All 155mm*** M483, M864, M898, M692, M731, M718, M741, M804, M110, M485, M825	→ ***All 105mm*** M915, M60A2, M84A1, M314A3, XM1064, M444, M548, M760, M1, M913, M927
Fuzing Function		Point Detonation , Proximity	Delay, GPS function →	→
Setter		EPIAFS	→	→
GPS Signal	P(Y)	P(Y)	→	→
GPS Black Keys	SAASM	SAASM	→	→
Anti-Jam		Limited to SAASM	20dB BB, 40dB Tone →	→
Operating Temp (F)		-25° F to +145° F (T) -50° F to +145° F(O)	→	→
Shelf Life		20 years		

PGK Program Plan

Increment 1
- <50m CEP,
- 155mm HE only
- If Phase 1 of TD is successful, IOC in FY10

Increment 2
- <30m CEP,
- All 155mm projectiles

Increment 3
-<30m(T) to 10m(O) CEP
-All 105mm projectiles



Summary

- PGK successfully completed Milestone A on 20 December 2005
- Planned approach is an incremental development to address Army near term requirements
  - ✓ Increment 1: 50m CEP for 155mm HE
  - ✓ Increment 2: 30M CEP for all 155mm projectiles
  - ✓ Increment 3: 30m CEP Threshold, 10m CEP Objective for all 155mm and 105mm projectiles
- TD contracts awarded to ATK and BAE 30 June 2006
  - ✓ Conduct TD Demonstration Test in April 2007
  - ✓ Conduct 18 month Systems Development and Demonstration (SDD) option
  - ✓ Conduct three 12 month Production options
- PGK program is on track
  - ✓ TD Demonstration Test scheduled for late April 2007
  - ✓ SDD contract award on schedule for May 2007

Excalibur

XM982

Excalibur: Fact or Fiction?

FACT

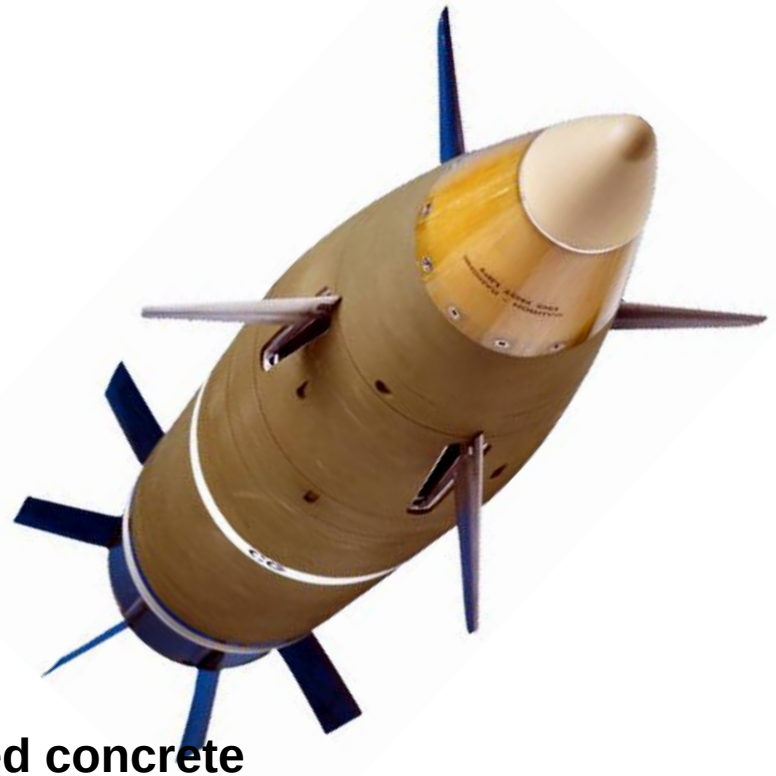
- 155mm GPS-guided, Precision munition
- Fire and Forget
- All weather
- Unitary Warhead
- Optimized for urban/complex terrain

FICTION

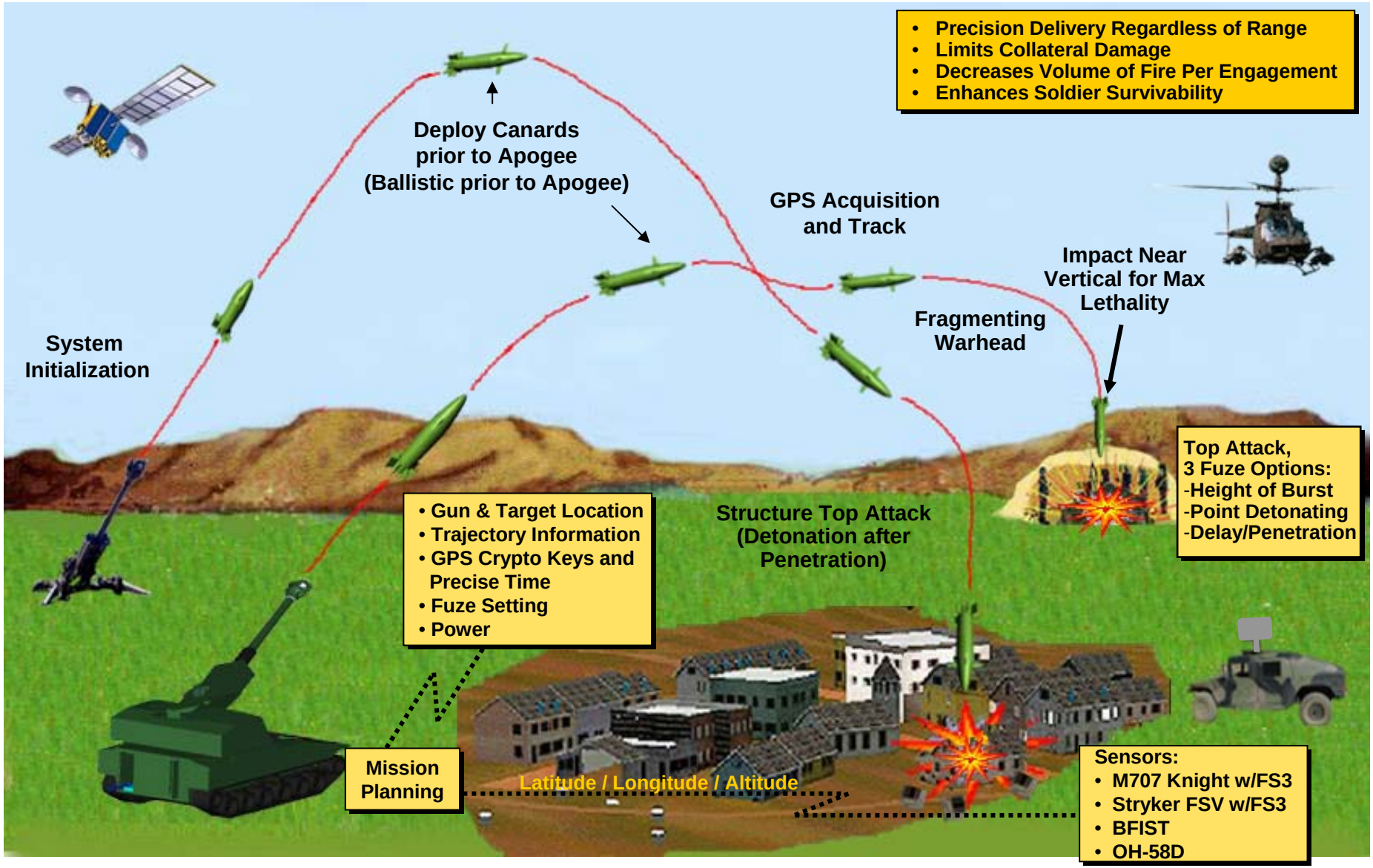
- Not a replacement for Copperhead
- Not pin-point accurate; no laser designation
- Not a “guided missile”
- Not a tank killer

Basic Characteristics & Capabilities

- Range
  - 7.5 km min range
  - Early fielding, 24km
- Always a high angle mission
- Near vertical terminal angle
  - Approximately 80-85 degrees
- 10m CEP at all ranges
- 30m Safe Arm Distance
- GPS guided, IMU backup
- 3 Fuze options:
  - PD
  - Delay – up to 8 inches of reinforced concrete
  - Proximity HOB
- No manual fuze setting; must be set with Enhanced Portable Inductive Artillery Fuze Setter



Concept of Operations

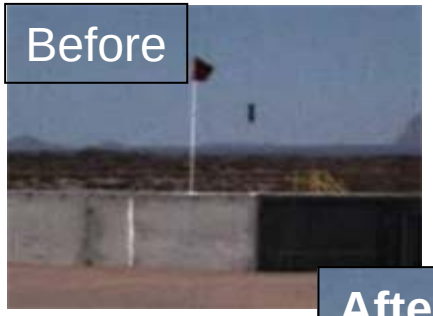


Excalibur Status

- Safety Qualification Testing Complete
- First Article Testing Complete
- Limited User Test (LUT) 7-17 Feb 07 at YPG
- Initially 65 rounds, then up to 500 over year of production.
- NET team to arrive in theater early May 07.

UMR Projectiles delivered to theater Apr 07

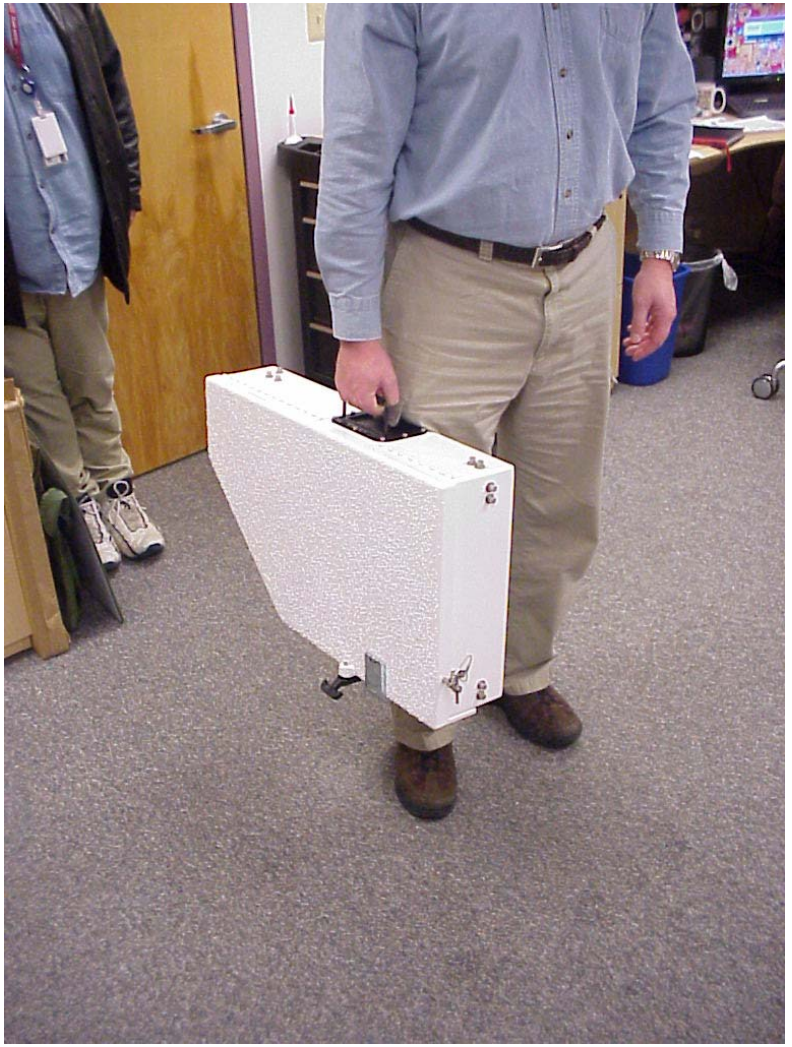
Reliability currently 91%



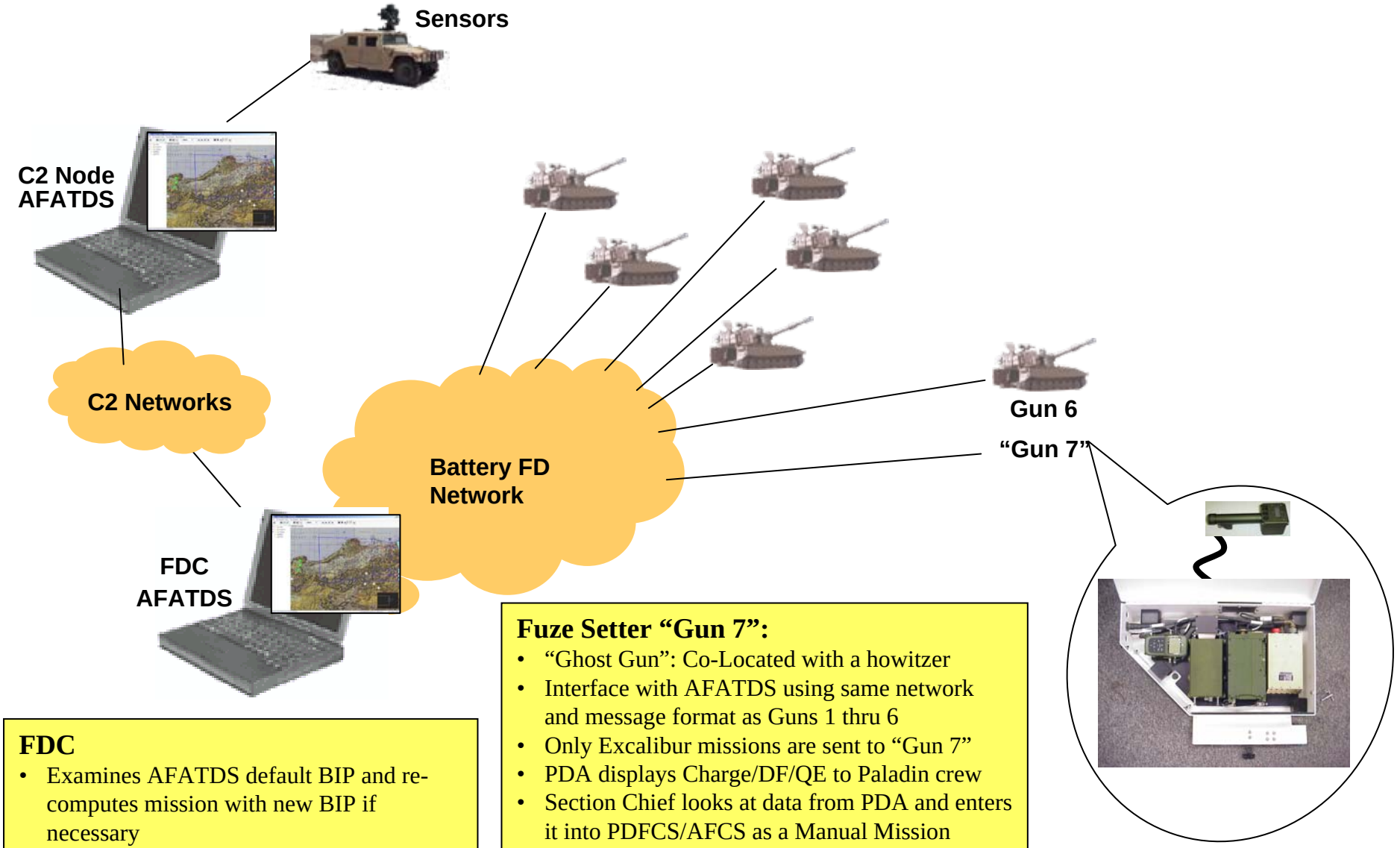
Excalibur LUT Videos

Back Up

Portable Excalibur Fire Control System (PEFCS)



AFATDS/PEFCS Interoperability



FDC

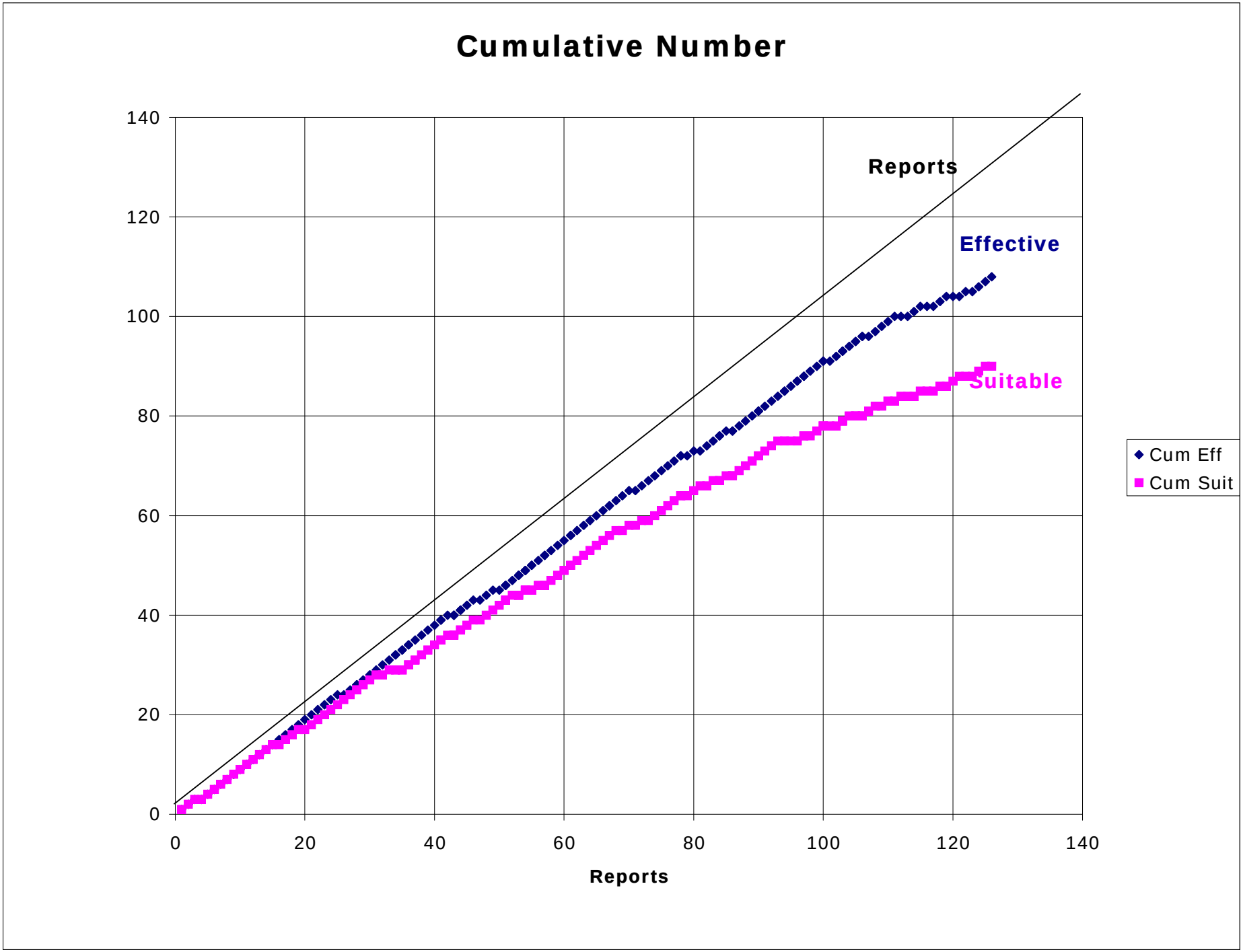
- Examines AFATDS default BIP and re-computes mission with new BIP if necessary
- FDC operator maintains Excalibur ammo count on AFATDS for gun "7"

Fuze Setter "Gun 7":

- "Ghost Gun": Co-Located with a howitzer
- Interface with AFATDS using same network and message format as Guns 1 thru 6
- Only Excalibur missions are sent to "Gun 7"
- PDA displays Charge/DF/QE to Paladin crew
- Section Chief looks at data from PDA and enters it into PDFCS/AFCS as a Manual Mission
- Section Chief uses PDA to send "Shot" to FDC

The Costs of Unsuitability and Benefits of Building in Reliability, Availability and Maintainability

Dr. Ernest Seglie,
Science Advisor, DOT&E
Ernest.Seglie@osd.mil


Cumulative Number
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
Reports
Reports
Effective
Suitable
Cum Eff
Cum Suit

DoD IOT&E Results FY 2001 - 2003

Program	Service	ACAT	IOT&E Result		Reason
FY 2001					
F-15 TEWS	USAF	II	Effective	Not Suitable	Reliability, Maintainability, Availability
V-22 Osprey	Navy	1D	Effective	Not Suitable	Reliability, Availability, Maintainability (RAM), Human Factors, BIT
Joint Direct Attack Munitions (JDAM)	USAF	1C	Effective only with legacy fuses	Not Suitable	Integration with delivery platforms
M2A3 Bradley Fighting Vehicle	Army	1D	Effective	Suitable	
FY 2002					
Joint Primary Aircraft Training System (JPATS)	USAF	1C	Effective with deficiencies	Not Suitable	RAM, Safety, Human Factors
Cooperative Engagement Capability (CEC)	Navy	1D	Effective	Suitable	
Multiple Rocket Launcher System (MLRS)	Army	1C	Effective	Suitable	
MH-60S	Navy	1C	Effective	Not Suitable	RAM, excessive administrative and logistic repair time impacted RAM
FY 2003					
B-1B Block E Mission Upgrade Program	USAF	1D	Effective	Not Suitable	16% decrease in weapons release rate, reduction in accuracy of Mark 82 low drag weapons, 14% hit rate on moving targets
Sea wolf Nuclear Attack Submarine	Navy	1D	Effective	Suitable	Several requirement thresholds were not met but overall system effective and

DoD IOT&E Results FY 2004, 2005

Program	Service	ACAT	IOT&E Result		Reason
FY 2004					
Evolved Sea sparrow Missile	Navy	II	Effectiveness unresolved	Suitable	Testing was not adequate to determine effectiveness.
Stryker	Army	1D	Effective	Suitable	
Advanced SEAL Delivery System (ASDS)	Navy	1D	Effective with restrictions	Not suitable	Effective for short duration missions; not effective for all missions and profiles. Not suitable due to RAM.
Tactical Tomahawk	Navy	1C	Effective	Suitable	
Stryker Mortar Carrier-B (MC-B)	Army	1D	Effective	Not Suitable	RAM and safety concerns.
FY 2005					
CH-47F Block I	Army	1C	Effective	Not Suitable	RAM; communications system less suitable than CH-47D; did not meet Information Exchange Requirements for Block I.
F/A-22	USAF	1D	Effective	Not Suitable	RAM; needed more maintenance resources and spare parts; BIT
Joint Stand-Off Weapon-C	Navy	1C	Not Effective		Not effective against moderately hardened targets; mission planning time was excessive.
Guided-MLRS	Army	1C	Effective	Suitable	
High Mobility Attack Rocket System (HMARS)	Army	1C	Effective	Suitable	
V-22 Osprey	Navy	1D	Effective	Suitable	
EA-6B (ICAP III)	Navy	II	Effective	Suitable	

Air Force IOT&E Results

Program	Service	ACAT	IOT&E Result		Technical Reason
FY 2002					
F-15 TEWS	USAF	II	Effective	Not Suitable	RAM

SE Issues		
Issue	**SE Area**	**Rationale**
Requirements	Reasonableness Verification	RAM requirements not fully defined. BIT architecture and subsystem reliability not designed into system. BIT system was a major requirement for the system.
Program Planning	Allocation Sufficiency	Program focused mainly on Band 1.5 and did not address newer SAM systems; inadequate processing capability. Systemic analysis was not performed; might have captured systems integration problems and identified root causes for inadequate processing.
Acquisition Strategy	Acceptability	Program integrated Electronic Warfare (EW) systems with known reliability issues without performing a systemic analysis prior to design and integration.
Technical Process	Requirements Development System Integration, Test, and Verification	Program did not establish sound independent technical review processes. Software assurance and metrics not sufficiently established. Technical entrance and exit criteria not established for Developmental Test (DT) reviews and decisions.

Air Force IOT&E Results

Program	Service	ACAT	IOT&E Result		Technical Reason
FY 2002					
Joint Primary Aircraft Training System (JPATS)	USAF	1C	Effective with deficiencies	Not Suitable	RAM; safety; human factors.

SE Issues		
Issue	**SE Area**	**Rationale**
Requirements	Reasonableness Verification	No ORD Thresholds for R&M; program measured against objectives.
Program Planning	Allocation Sufficiency	Acquisition Reform – pilot program. Designed as COTS program. Multiple slips: evidence of a schedule-driven nature. Requirements not fully defined and understood.
Acquisition Strategy	Acceptability	Simple COTS approach. “Militarization” not fully defined or understood. Multiple slips: evidence of schedule-driven nature.
Technical Process	Requirements Development System Integration, Test, and Verification	COTS mentality led to simplistic test approach (e.g., FAA cert, Contractor Qual Test approach led to insufficient DT). Multiple slips. Requirements not tracked/traced to a verification and test plan.

Air Force IOT&E Results

Program	Service	ACAT	IOT&E Result		Reason
FY 2001					
Joint Direct Attack Munitions (JDAM)	USAF	1C	Effective only with legacy fuses	Not Suitable	Excessive mission planning times (Navy); system reliability; B-52 load times; container deficiencies (stacking, carrier ops).

SE Issues		
Issue	**SE Area**	**Rationale**
Requirements	Reasonableness; Design Synthesis Verification	B-52 load times not reflective of new complexity. Navy carrier operability (ruggedness) not adequately captured/defined. Significant focus on capability (accuracy). Reliability relied heavily on “warranty.”
Acquisition Strategy	Acceptability	Acquisition Reform – pilot program. Small program office. Capability-based contracting strategy; significant SE contracted as result. Significant focus on capability (accuracy). Reliability relied heavily on “warranty.”
Technical Process	System Integration, Test, and Verification	Unrealistic load times; test team load crew experience, training; test team mission planning experience/training.
Reducibility and Production Planning	Quality Control (Plant Layout)	Storage reliability. Significant failures related to minor quality control errors (i.e., missing sealant, kit packed with wrong covers, etc.).

Air Force IOT&E Results

Program	Service	ACAT	IOT&E Result		Reason
FY 2003					
B-1B Block E Msn Upgrade Program	USAF	1D	Not Effective	Suitable	16% decrease in weapons release rate; reduction in accuracy of Mark 82 low drag weapons; 14% hit rate on moving targets.

SE Issues		
Issue	**SE Area**	**Rationale**
Requirements	Reasonableness Verification	Validity of effectiveness measures, based on comparison with prior block (not as complex; different release mechanism; different weapons mix; key requirement met: weapons flexibility).
Acquisition Strategy	Acceptability; Sufficiency	Software conversion oversimplified. Significant program growth. “Program clarity” - funded program did not address numerous “known issues”; resulted in re-identification of numerous issues (situational awareness, controls and displays, reliability).
Technical Process	System Integration, Test, and Verification	T&E measures not well founded in ORD/CDD.

Air Force IOT&E Results

Program	Service	ACAT	IOT&E Result		Reason
FY 2003					
F-22	USAF	1D	Effective	Not Suitable	RAM; needed more maintenance resources and spare parts; BIT.

SE Issues		
Issue	**SE Area**	**Rationale**
Requirements	Reasonableness Verification	RAM requirements not fully defined for IOT&E but for a mature aircraft at 100K flight hours. RAM and BIT requirements not tracked/traced to a verification or test plan.
Acquisition Strategy	Acceptability; Sufficiency	Program did not recognize or fully fund RAM requirements and software development, especially the maintenance software portion. Labs were insufficiently supported with hardware-in-the-loop.
Technical Process	System Integration, Test, and Verification	Program did not establish entrance/exit criteria for software development, verification, validation, and test. Software not adequately tested and fixed in the lab prior to flight test. Mission technical issues overshadow RAM issues and RAM resources diverted to technical mission issues. Program did not have a sound risk assessment program.

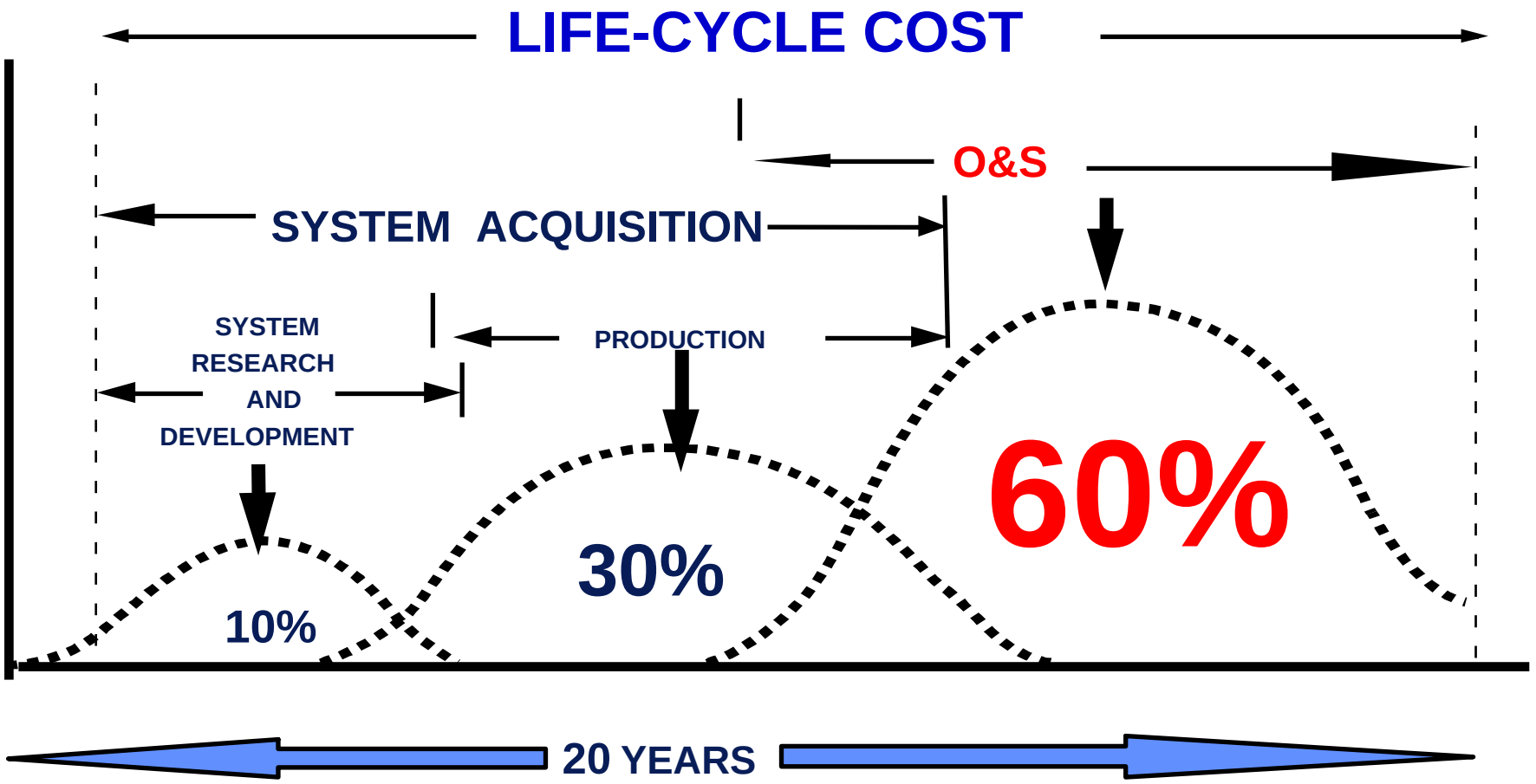
Additional Costs When a System is Judged Unsuitable (1)

- Some programs extended their SDD and added resources to redesign, reengineer and to retest till they became suitable
  - V-22 extended its SDD by five years and spent ~$1B to resolve its suitability issues. (It had a catastrophic failure in 2000)
  - C-17 is likely to be another interesting case.
- When failure in OT&E delays the full production and the fielding of a new system, it may require extra cost to operate and support, and in some cases, even Service Life Extension Program (SLEP) on legacy systems.

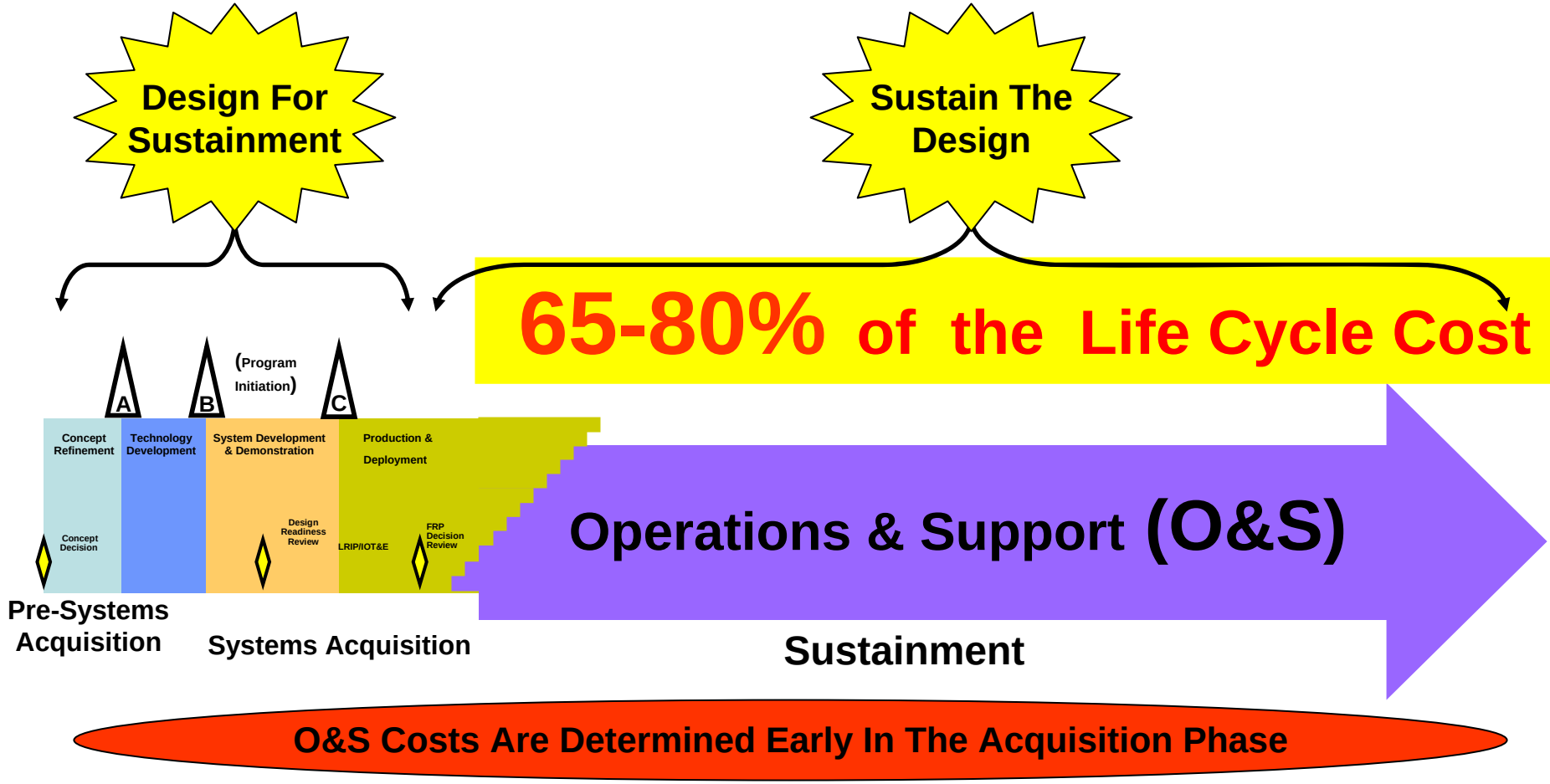
Additional Costs When a System is Judged Unsuitable (2)

- Some programs were granted FRP and delayed RAM remedial actions as Block Upgrades
  - Approach requires additional cost for RDT&E and retrofit. It is also more expensive to maintain and support several different configurations than one.
  - It turns to a spiral development approach.
  - Identify related RAM development and retrofit costs
  - Estimate additional operating and support costs for extra configurations
- Some programs are fielded with known RAM shortcomings
  - Extra costs for repair and maintenance or contractor logistic support when fielded at insufficient RAM level
  - Possible cost to procure and operate additional units to compensate for low availability to meet desired sortie rates or ton-mile capacity

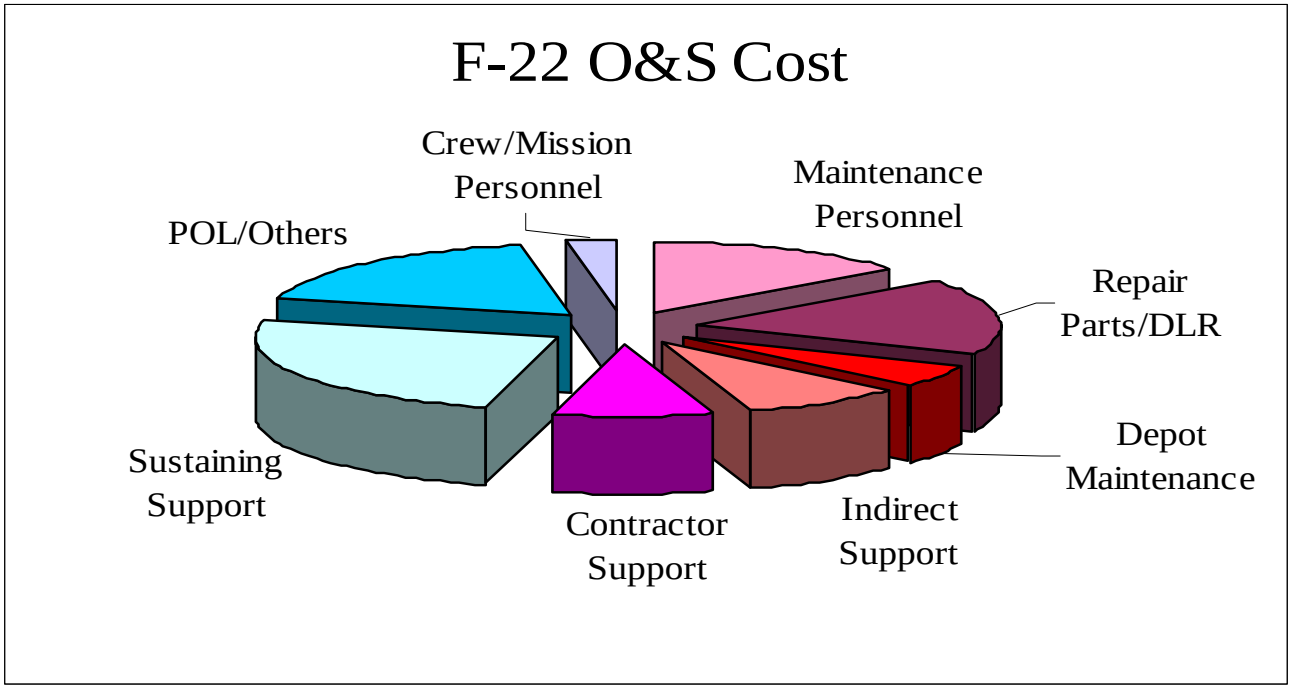
LCC Distribution



Life Cycle Management



R&M drives O&S Costs



R&M affects about half of F-22 O&S cost:

Maintenance personnel, repair parts/depot level repairables, depot maintenance, indirect support and contractor support

Four Causes

- No requirements
- Lack of incentives
- Attention elsewhere
- Poor Systems Engineering

JROC Memo: 17 Aug 2006

"MATERIEL AVAILABILITY" KPP for all MDAPs and Select ACAT II and III

(KSAs):

A. Materiel Reliability KSA

B. Ownership Costs KSA

JROC Approved* Mandatory Sustainment KPP and KSAs

- Single KPP:
  - **Materiel Availability** $\left(= \frac{\text{Number of End Items Operational}}{\text{Total Population of End Items}}\right)$
- Mandatory KSAs:
  - **Materiel Reliability** (MTBF)$\left(= \frac{\text{Total Operating Hours}}{\text{Total Number of Failures}}\right)$
  - **Ownership Cost** (O&S costs associated w/materiel readiness)
- Ownership Cost provides balance; solutions cannot be availability and reliability “at any cost.”

***JROC Approval Letter JROCM 161-06 Signed 17 Aug 06; Revised CJCS 3170 will put into Policy**

Return on Investment

Estimate O&S and Initial Spares of Different F-22 MTBMs (Constant 2006 $B)

Reliability Level at Maturity		MTBM in Hours (1)	O&S & Initial Spares (2)	Life Cycle Cost Difference (3)
FOT&E Actual	(1a)	**0.65**	**$ 42B**	**$ 7B**
IOT&E Actual with Historical Growth	(1b)	**0.83**	**$ 40B**	**$ 5B**
Air Force Program Reliability Projection	(1c)	**1.50**	**$ 35B**	

(1) Mean Time between Maintenance. F-22 ORD established MTBM threshold at 3 hours.
- (1a) MTBM of 0.65 hours achieved in Follow-on Operational Test and Evaluation (FOT&E).
- (1b) IOT&E MTBM score 0.45 hours. F-22 will achieve MTBM of 0.825 hours at maturity (100,000 FH), if its reliability growth rate is similar to the historical rates of existing fighter aircraft programs.
- (1c) Air Force Program Office projects F-22 to achieve 1.5 hours MTBM at maturity.

(2) O&S cost for 148 Primary Aerospace vehicle Authorization (PAA), 336 flying hours per aircraft per year for 24 years. Initial spares requirement for 182 Total Active Inventory (TAI), computed at $120M recurring flyaway cost each.

(3) Baseline assumes the Air Force projected 1.5 hours MTBM at maturity. At the F-22 ORD MTBM threshold of 3 hours, the estimated life cycle cost would be $4B lower than the baseline in constant 2006 dollars.

F-22 life cycle cost could be $5B – $7B (constant 2006) more if projected program reliability is not realized.

Return of R&M Investment
(Present Value 2006 $B)

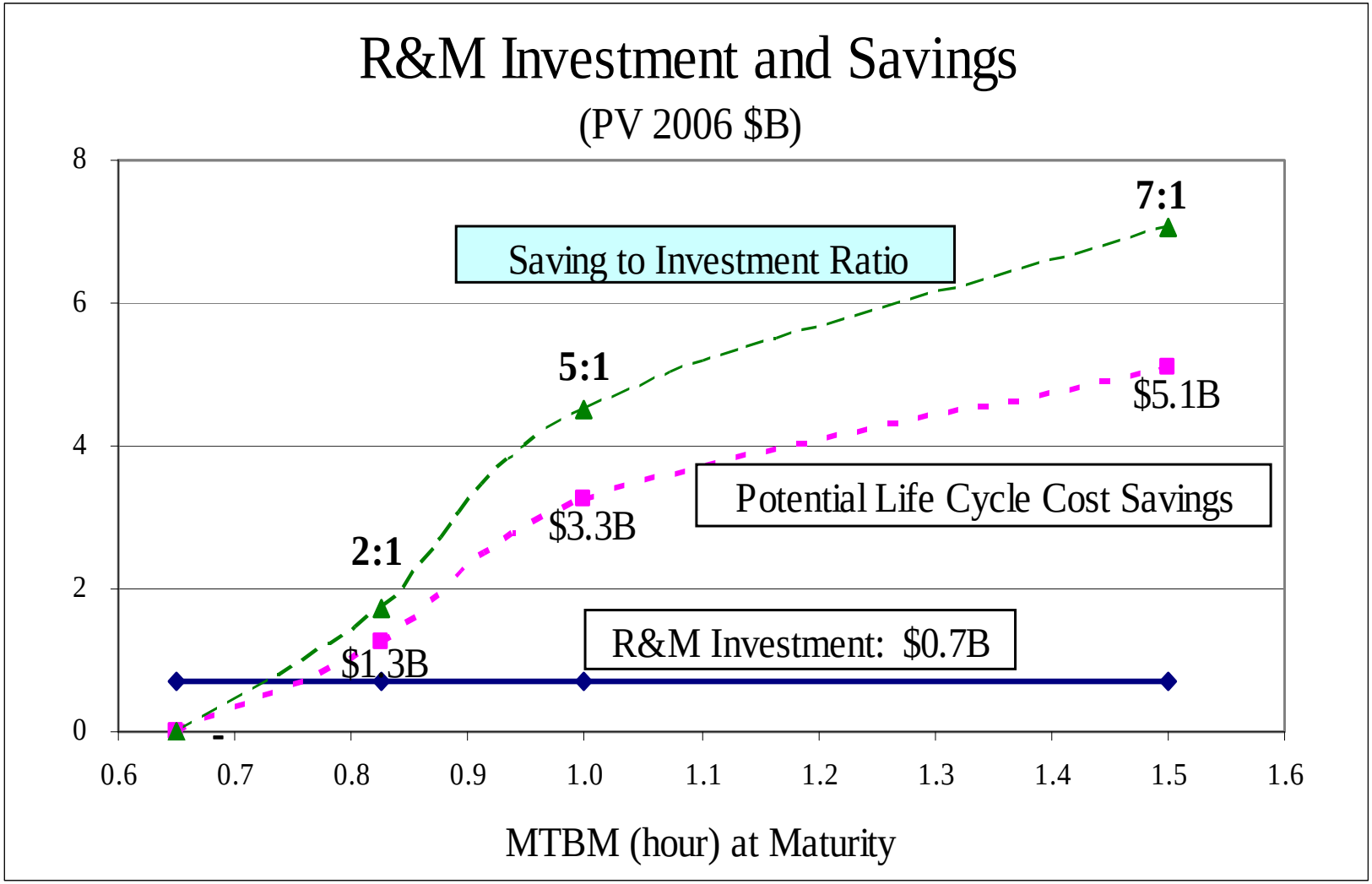
Reliability Level at Maturity	MTBM in Hours (1)	O&S & Initial Spares (2)	RDT&E & Retrofit (3)	Savings to Investment Ratio
FOT&E Actual	0.65	$ 30B		
Air Force Program Reliability Projection	1.50	$ 25B		
Potential Savings (4)		**$ 5B**		
Budgeted Investment			**$ 0.7B**	
Potential Return of Investment				**7 : 1**

(1) Mean Time between Maintenance. F-22 ORD established MTBM threshold at 3 hours.
F-22 Follow-on Operational Test and Evaluation (FOT&E) MTBM score 0.65 hours.
Air Force Program Office projects F-22 to achieve 1.5 hours MTBM at maturity.

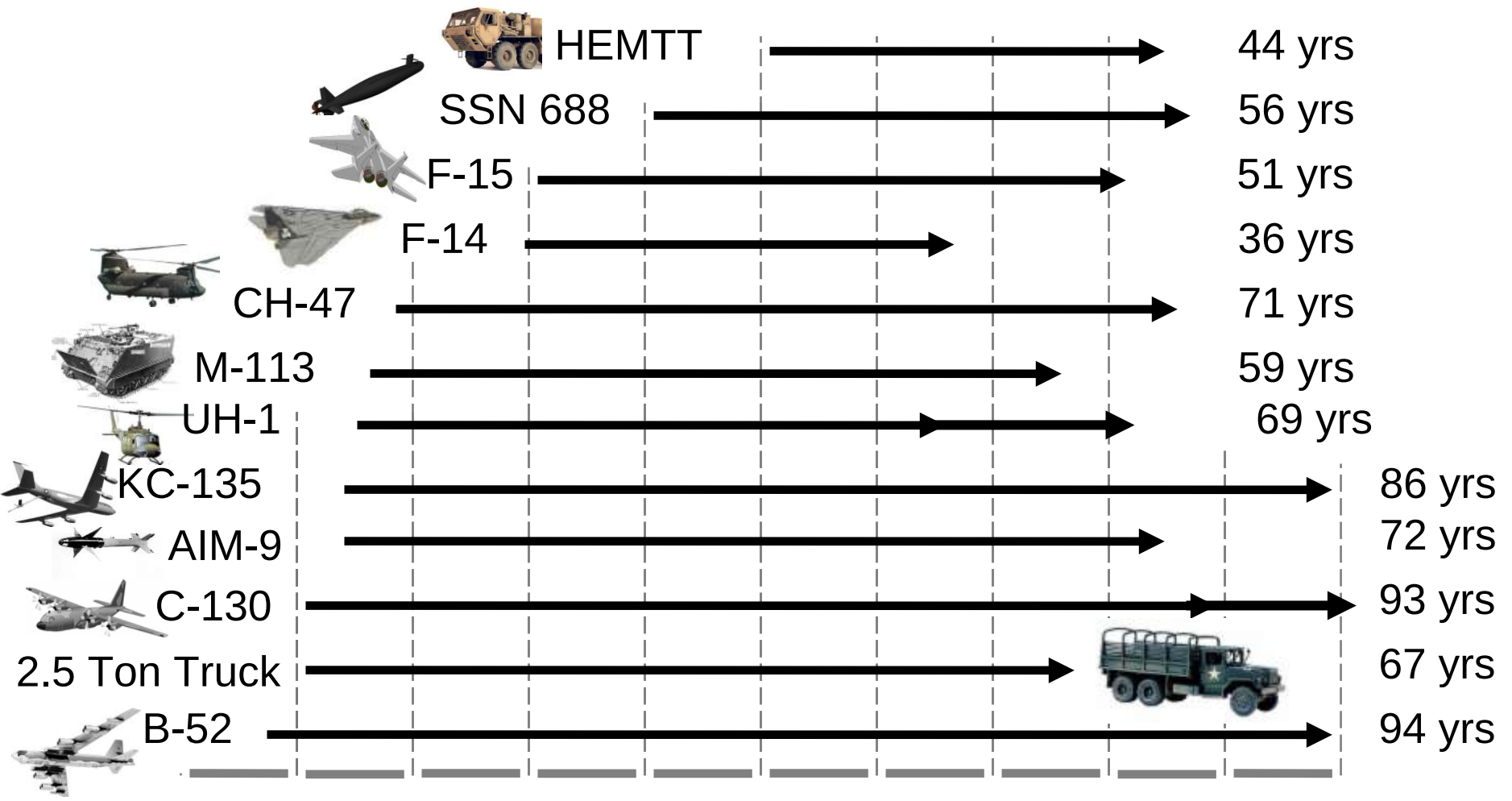
(2) O&S cost for 148 Primary Aerospace vehicle Authorization (PAA), 336 flying hours per aircraft per years for 24 years.
Initial spares requirement for 182 Total Active Inventory (TAI), costed at $120M recurring flyaway cost per aircraft.

(3) President Budget Submission (February 2005 and February 2006):
F-22 Reliability and Maintainability Maturation Program (RAMMP).
F119 engine Component Improvement Program (CIP).
R&M retrofits: air vehicle RAMMP modification and F119 engine CIP modification

(4) Saving will be substantially lower if F-22 does not achieve MTBM of 1.5 hours at maturity.


R&M Investment and Savings
(PV 2006 $B)
8
6
4
2
0
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
7:1
Saving to Investment Ratio
5:1
$5.1B
Potential Life Cycle Cost Savings
$3.3B
2:1
$1.3B
R&M Investment: $0.7B
-
MTBM (hour) at Maturity

Defense System Life Cycles



SOURCE: John F. Phillips DUSD (L)

Myths about Building-in Reliability, Availability and Maintainability

Myth 1: Building-in Reliability costs money.

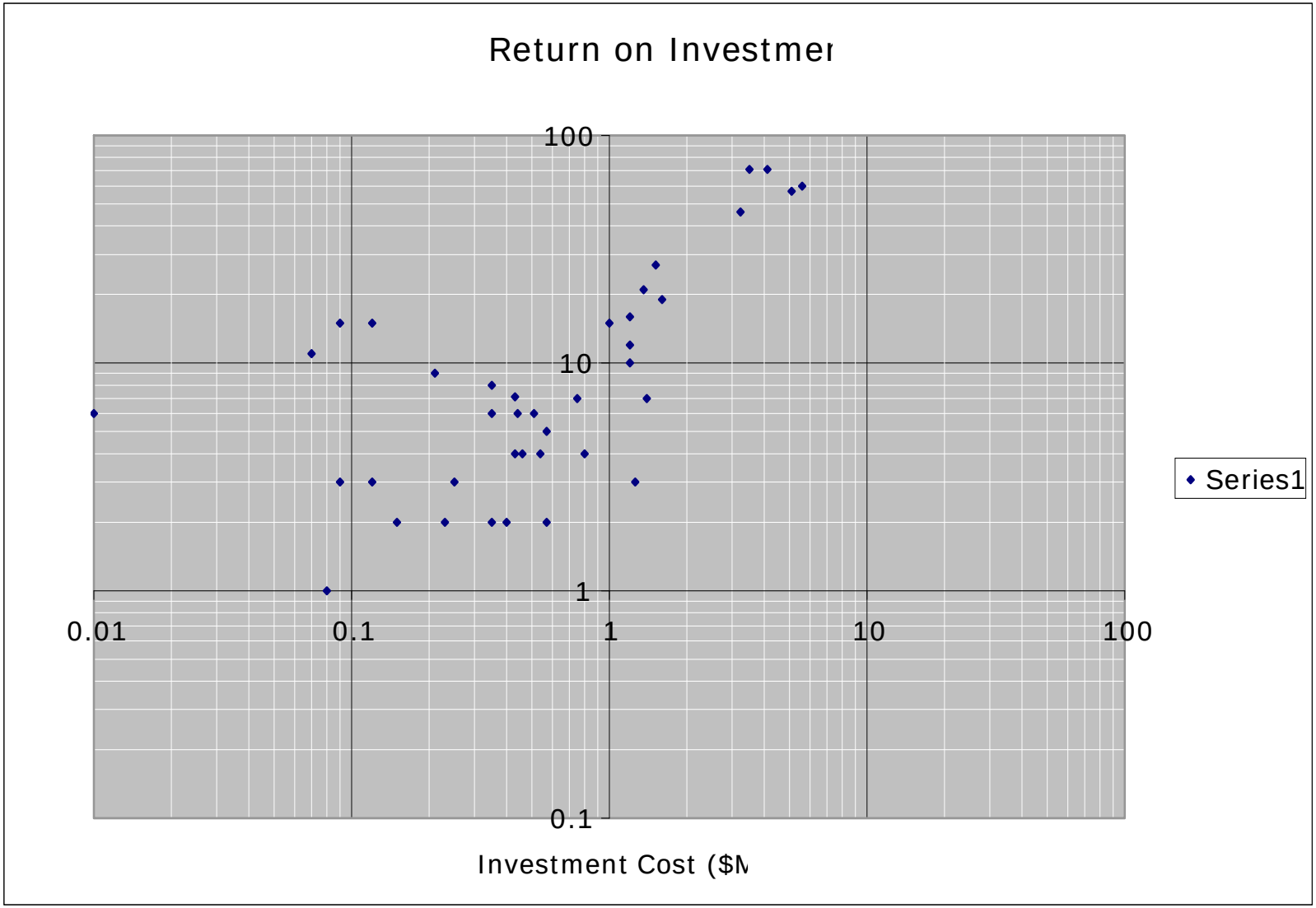
HH-60H and MH-60S Reliability and Cost Comparison

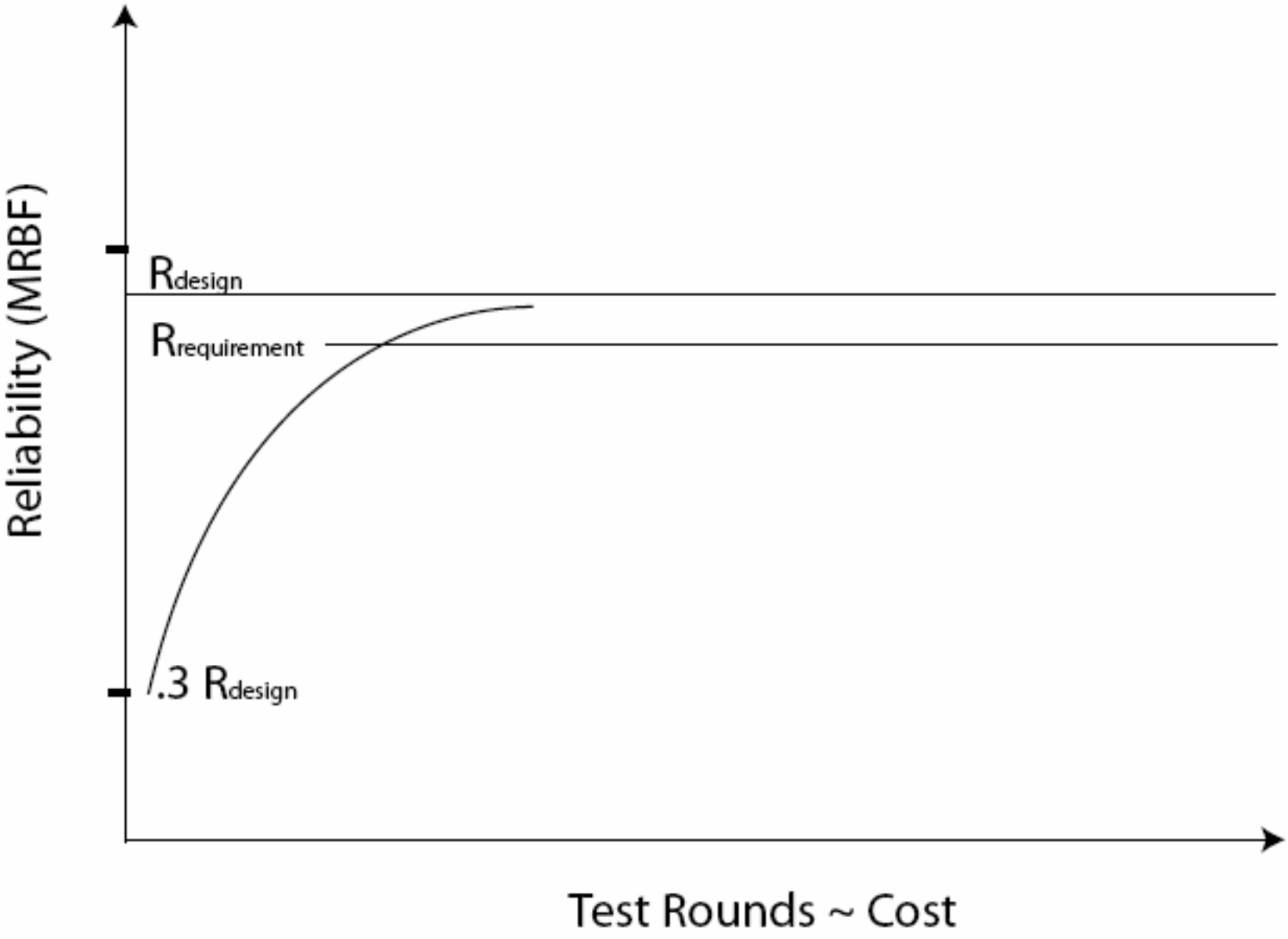
HH-60H		
Component	**MFHBR**	**PUC (FY07$K)**
CPU159/A AFCS COMPUTER	582	$180
AUXILIARY POWER SYSTEMS	2,160	$86
SECT'S 2/3/4 DRIVE SHAFT ASSY	6,480	$4
CP1820/ASN150 NAV COMPUTER	434	$99
STABILATOR AMPLIFIER INSTALL	549	$34
MLG DRAG BEAM/AXLE ASSY	*>10,000	$24
FLOOR ASSEMBLY	*>10,000	$10
T1360( )/ALQ144(V) TRANSMITTER	582	$52

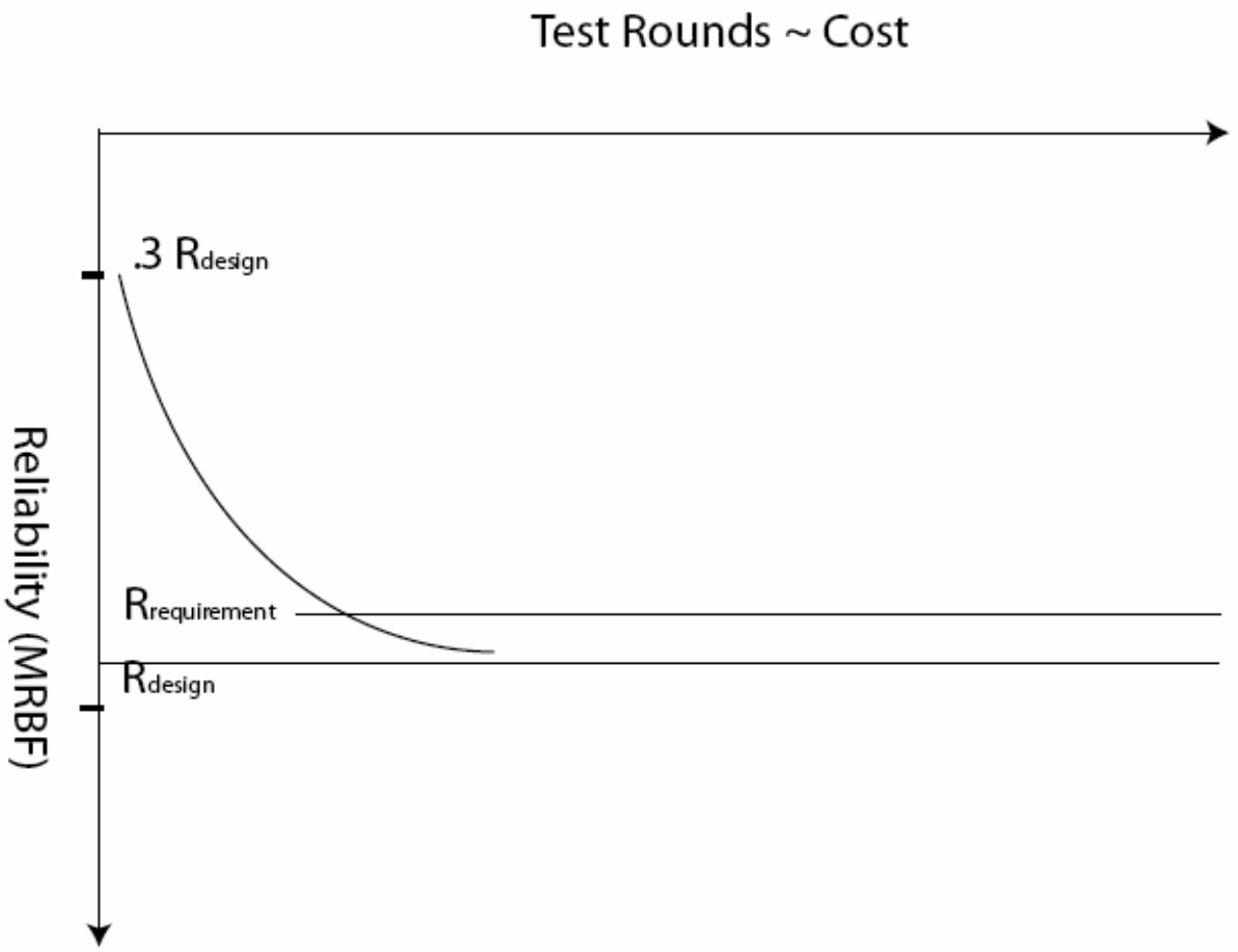
MH-60S		
Component	**MFHBR**	**PUC (FY07$K)**
CPU133/A DIGITAL COMPUTER	1,944	$86
ACFT POWER UNIT	*>10,000	$80
SECTIONS 2/3/4 DRIVE SHAFT ASSY	*>10,000	$4
CP-2428/A DIGITAL DATA COMPUTER	2,236	$84
AMPLIFIER INSTALLATION	1,351	$43
BEAM-AXLE ASSEMBLY	*>10,000	$26
AIRCRAFT FLOOR	*>10,000	$20
LIGHT,INFRARED TRANSMITTER	*>10,000	$5

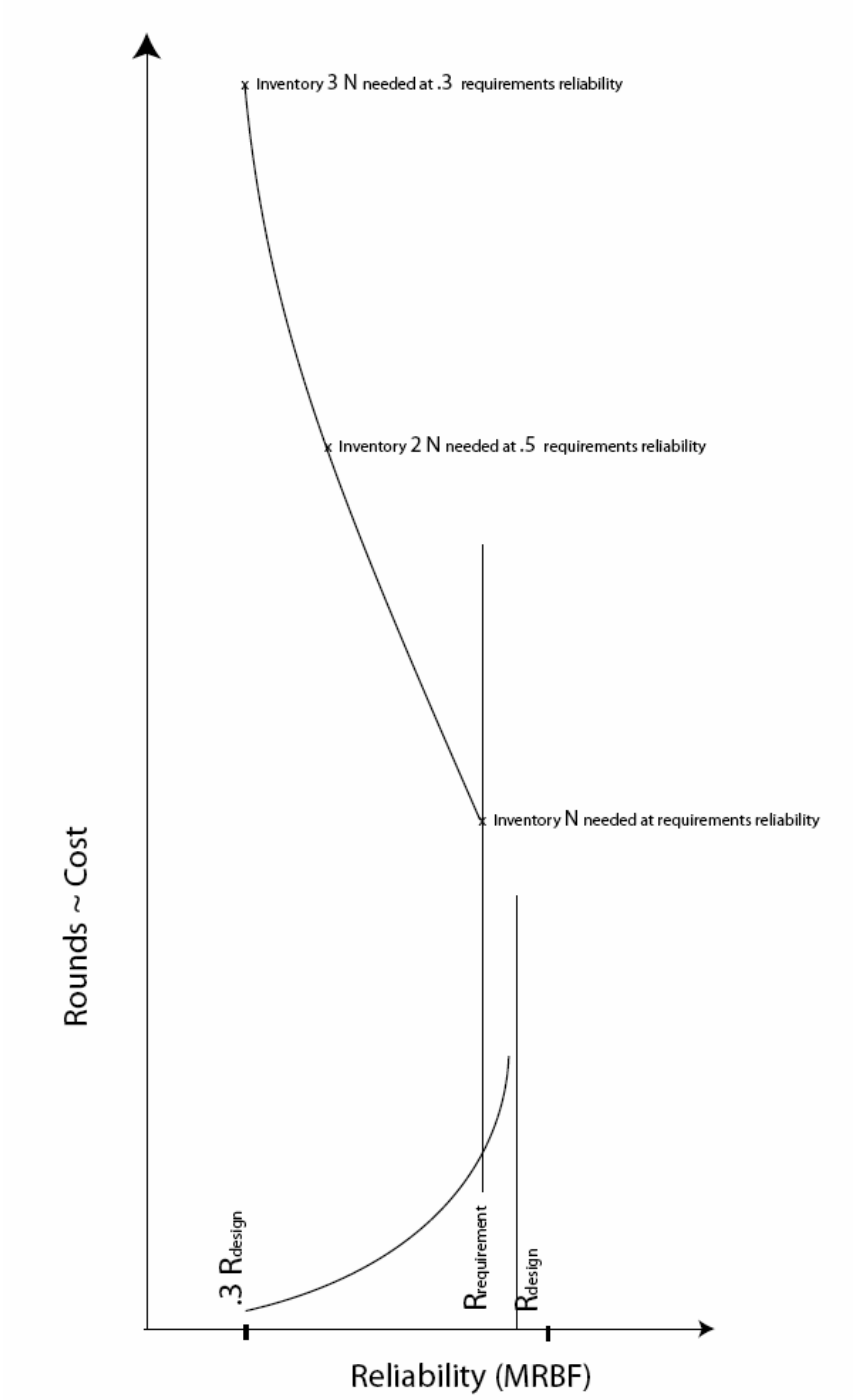
* 0 failures observed in one year

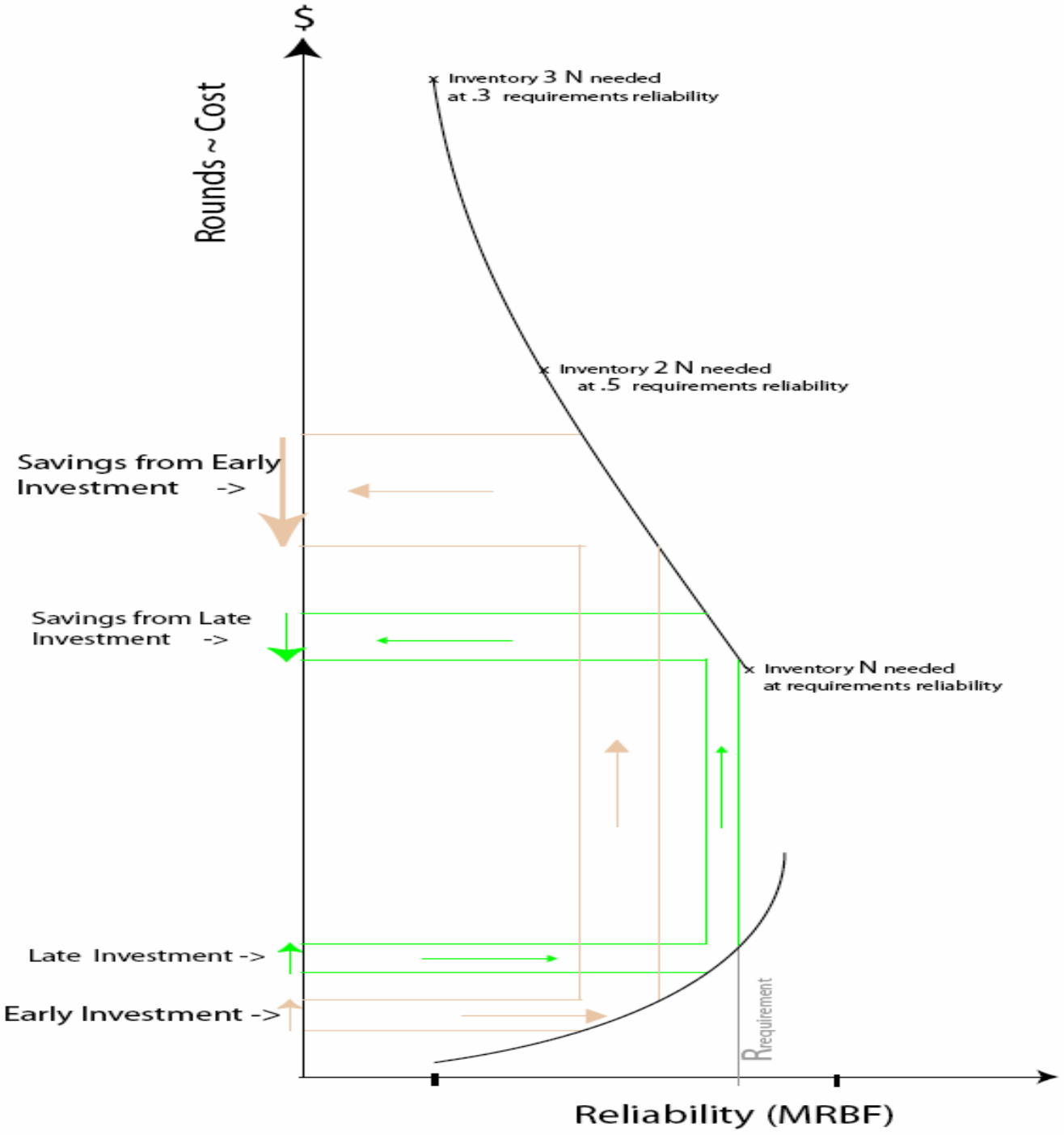
When to Invest?


Return on Investmer
100
10
1
0.1
0.01
0.1
1
10
100
Series1
Investment Cost ($M

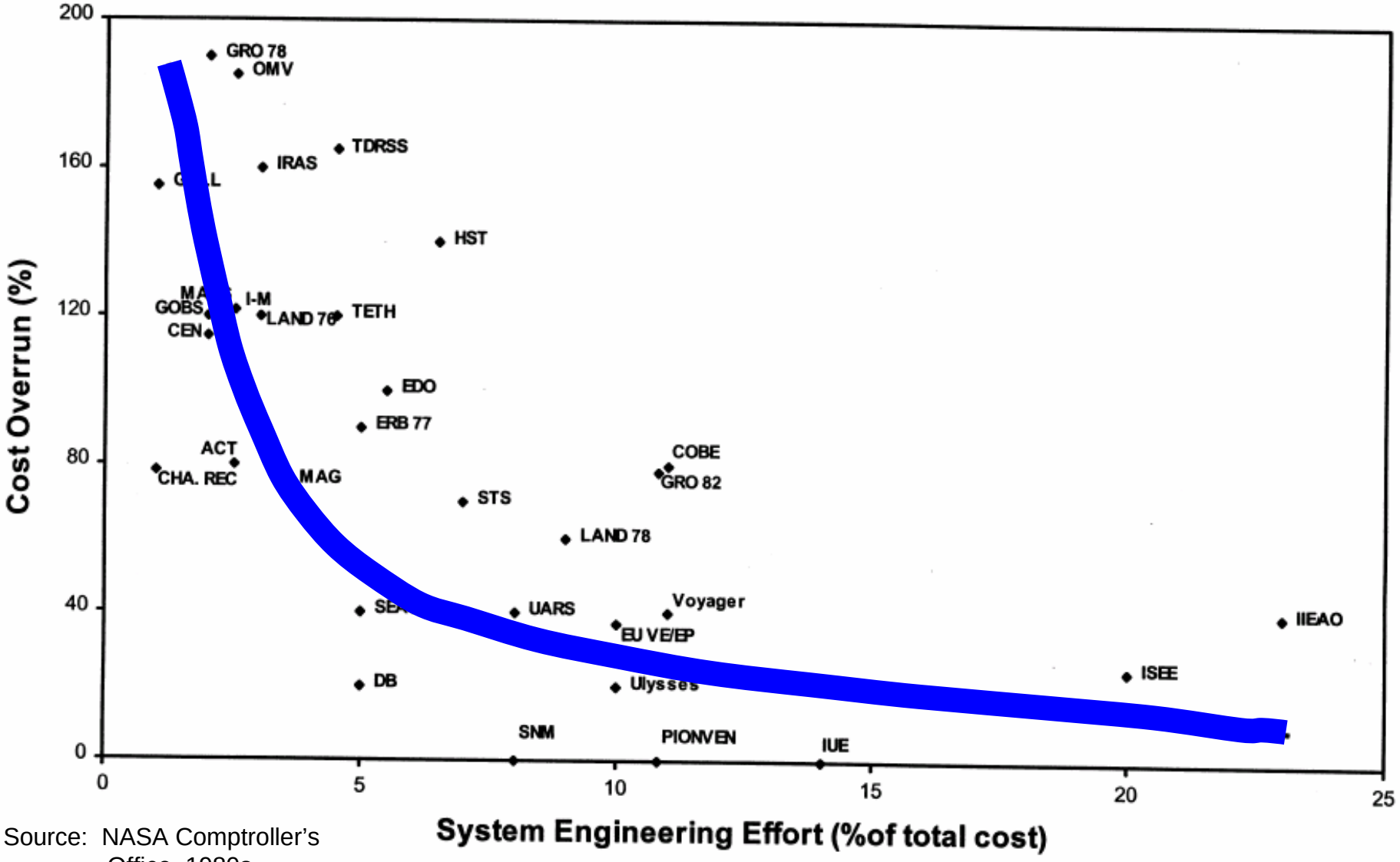

Reliability (MRBF)
Rdesign
Rrequirement
.3 Rdesign
Test Rounds ~ Cost


Test Rounds ~ Cost
.3 Rdesign
Reliability (MRBF)
Rrequirement
Rdesign


Inventory 3 N needed at .3 requirements reliability
Inventory 2 N needed at .5 requirements reliability
Inventory N needed at requirements reliability
Rounds ~ Cost
.3 Rdesign
Rrequirement
Rdesign
Reliability (MRBF)


$
Rounds ~ Cost
Inventory 3 N needed
at .3 requirements reliability
Inventory 2 N needed
at .5 requirements reliability
Inventory N needed
at requirements reliability
Savings from Early
Investment ->
Savings from Late
Investment ->
Late Investment ->
Early Investment ->
Rrequirement
Reliability (MRBF)

The Value of SE



– Source: NASA Comptroller's Office, 1980s

The Value of SE (cont.)

LTV Aerospace and Defense Company study on the benefits of the SE process – 1992

- Product development time reduced by as much as 60%
- Engineering change orders reduced by 50%
- Redesign and rework effort reduced by as much as 75%
- Manufacturing costs reduced by as much as 40%

Source: James Martin, Systems Engineering Guidebook, 1997

Benefits of Systems

Launch (Project)	# of Points	Cost ($K)	$ / Point	Use SE?
System 1	12,934	30,000	2,319	No
System 2	10,209	14,904	1,460	Yes
System 3	4,678	6,614	1,414	Yes
System 4	8,707	18,075	2,076	No
System 5	1,223	2,400	1,962	No
System 5	4,600	10,309	2,241	Yes
Total/Average	**42,351**	**82,302**	**1943**	**N/A**
Total/Average with SE	**19,487**	**31,827**	**1,633**	**Yes**
Total/Average without SE	**22,864**	**50,475**	**2,208**	**No**
Percent improvement			**35.17%**	

Over a two year span, IBM has seen a 35% cost saving (productivity improvement) in large-scale integration projects that use the Systems Engineering process.

Source: “Application of Templates and Metrics to Enhance and Assess Systems Engineering Effectiveness in the IT Sector”, D. Verma and P. Popick, Jan. 8, 2003.

Summary

- How to Address Problems
- Size of ROIs
- When to invest

THE END

Weapon Systems

CH-47
Multiple
UH-60
AH-64
CH-47 & AH-64
H-47/H-64
Ground Support
Patriot Missle
B-1B
A-10
F-16
C-130
B-52
C-5A/F-15
F-15
F-15/Multiple
F-15 & F-16
KC-135
F100/F-119
Minuteman
Multiple (Fuel)
F/A-18
Multiple (Navy)
EA-6B
H-60
AV-8B
T-64
F404
AH-1/H-46
C-130/P-3
CH-46
E2-C-2
EA-6B, E-2/C-2
F/A-18 & E2/C2
H-1
HMMWV
T-58
T700
UH-1

Assessing Cost and R&M

- Models to link Mean Time Between Maintenance and other R&M metrics to requirements for
  - Maintenance manpower
  - Sustaining spares
  - Initial spares
- F-22 example
  - Compare the O&S cost and initial spares requirement for a range of reliability assumptions, following established analytical approaches for other F-22 Studies.
  - Tabulate the trade-off between budgeted F-22 R&M investment (RDT&E and retrofit) and potential O&S and initial spares savings.